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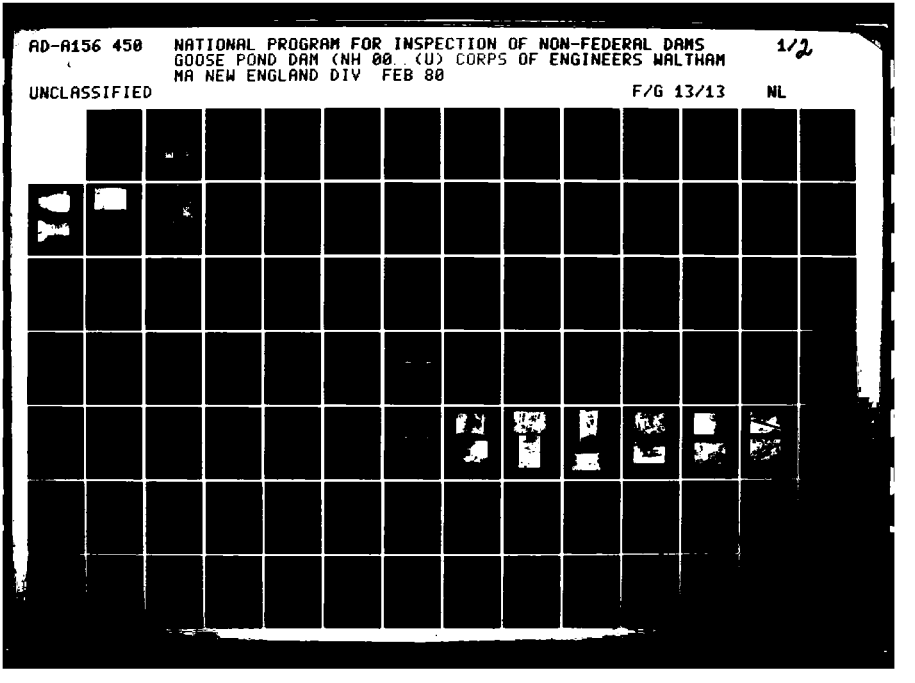

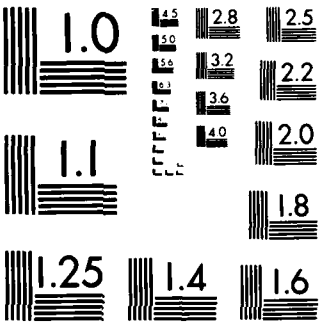

CONNECTICUT RIVER BASIN

KEENE, NEW HAMPSHIRE

GOOSE POND DAM

NH 00101

NHWRB 126.03

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

FEBRUARY 1980

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Connecticut River Basin
Keene, New Hampshire
Ashuelot River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is located on an unnamed tributary of the Ashuelot River. Tbe dam is an earth embankment about 210 ft. long and 23 ft. high. The dam was originally used as a water supply but now serves only as recreation. The dam is in fair condition. The drainage area covers 1.5 square miles and is made up primarily of mountainous woodland with some pasture and minor development. It is small in size with a high hazard potential.

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DEPARTMENT OF THE ARMY
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424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED-E

JUN 04 1980

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Goose Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Goose Pond Dam would likely be exceeded by floods greater than 6 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Hugh J. Gallen

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire, and the owner of the project, city of Keene, New Hampshire.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for the cooperation extended in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

GOOSE POND DAM
NH 00101

CONNECTICUT RIVER BASIN
KEENE, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

Identification No.:	NH 00101
NHWRB No.:	126.03
Name of Dam:	GOOSE POND DAM
City:	Keene
County and State:	Cheshire, New Hampshire
Stream:	Unnamed brook, a tributary of the Ashuelot River
Date of Inspection:	August 21, 1979

BRIEF ASSESSMENT

Goose Pond Dam is located on an unnamed tributary of the Ashuelot River, approximately 2½ miles upstream of Keene, New Hampshire. The dam is an earth embankment approximately 210 feet long and 23 feet high. The spillway is in natural ground approximately 200 feet to the right of the dam and consists of two broad-crested concrete weir bays, each 11.5 feet wide. There is also an earth dike approximately 1,500 feet left of the dam. It is 210 feet long and about 6 feet high. There is a 24 inch diameter outlet conduit through the main dam which is closed and is no longer operable.

The dam is owned by the City of Keene, New Hampshire. It was originally used as a water supply but now serves only for recreation.

The drainage area covers 1.5 square miles and is made up primarily of mountainous woodland with some pasture and minor development.

The dam normally impounds 522 acre-feet and has a maximum impoundment of 606 acre-feet. Its height of 23 feet and maximum impoundment both place it in the small size category. The hazard classification is high because of the large potential for loss of life at 60 house trailers which would flood one to four feet in the event of dam failure.

The adopted Test Flood for this dam is the Probable Maximum Flood (PMF). The peak inflow for this flood would be 3,825 cfs and would result in a peak outflow of 3,470 cfs. This peak outflow would overtop the main dam by 1.6 feet and the dike by 1.1 feet. The spillway capacity at the top of the dam (elevation 637) is 195 cfs or six percent of the routed Test Flood peak outflow.

The dam is in FAIR condition at the present time. Remedial measures to be undertaken by the owner include: rehabilitation or replacement of the waste gate, repair of the gatehouse, removal of debris from spillway and downstream channels, implementation of a program of maintenance and annual technical inspections, and development of a plan for surveillance of the dam during and immediately after periods of heavy rainfall and for warning downstream officials in the event of an emergency. Further investigations are recommended to evaluate the adequacy of the project discharge and to determine the source of wet areas at downstream toes of the dam and dike and the seepage at the spillway apron. It is also recommended that trees be carefully removed from the embankments and the resulting voids be backfilled with suitable compacted material.

The recommendations and remedial measures outlined above should be implemented within one year of receipt of this report by the owner.

William S. Zoino
NH Registration 3226

Nicholas A. Campagna, Jr.
California Registration 21006

This Phase I Inspection Report on Goose Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the Test Flood should not be interpreted as necessarily posing a highly inadequate condition. The Test Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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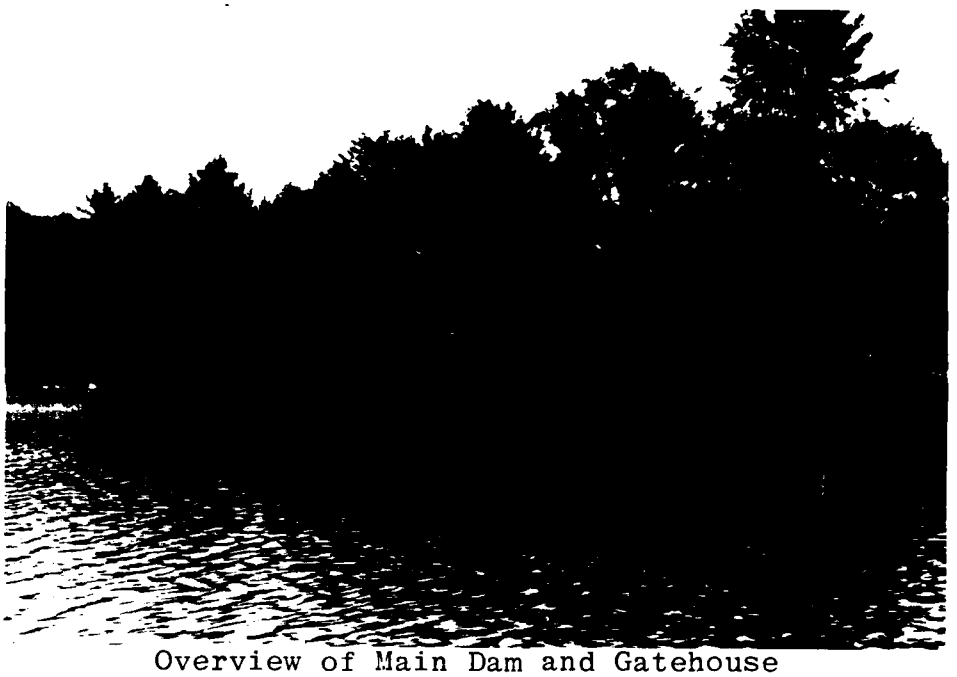
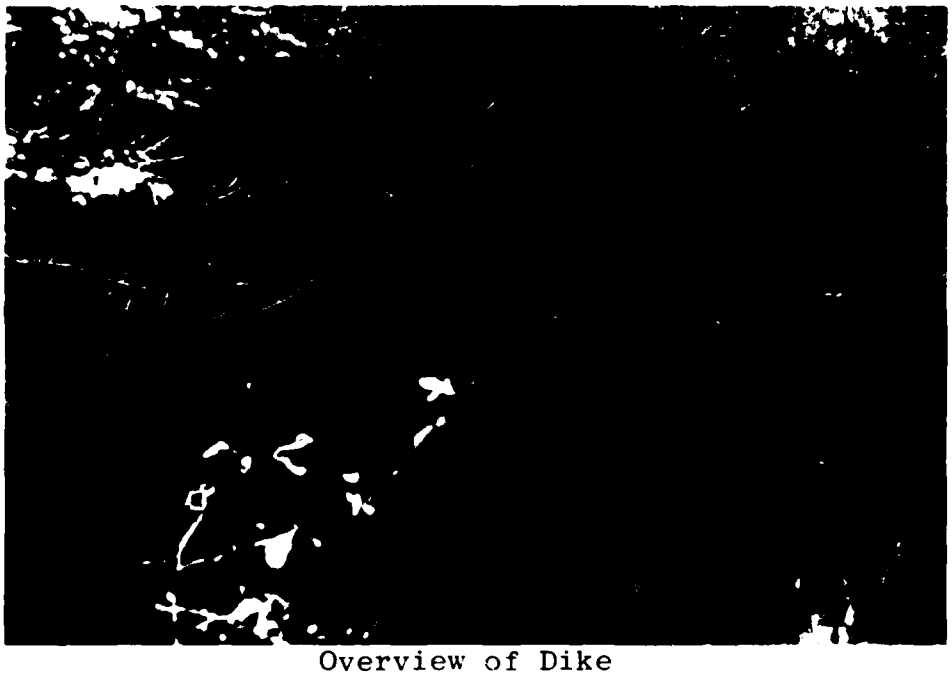
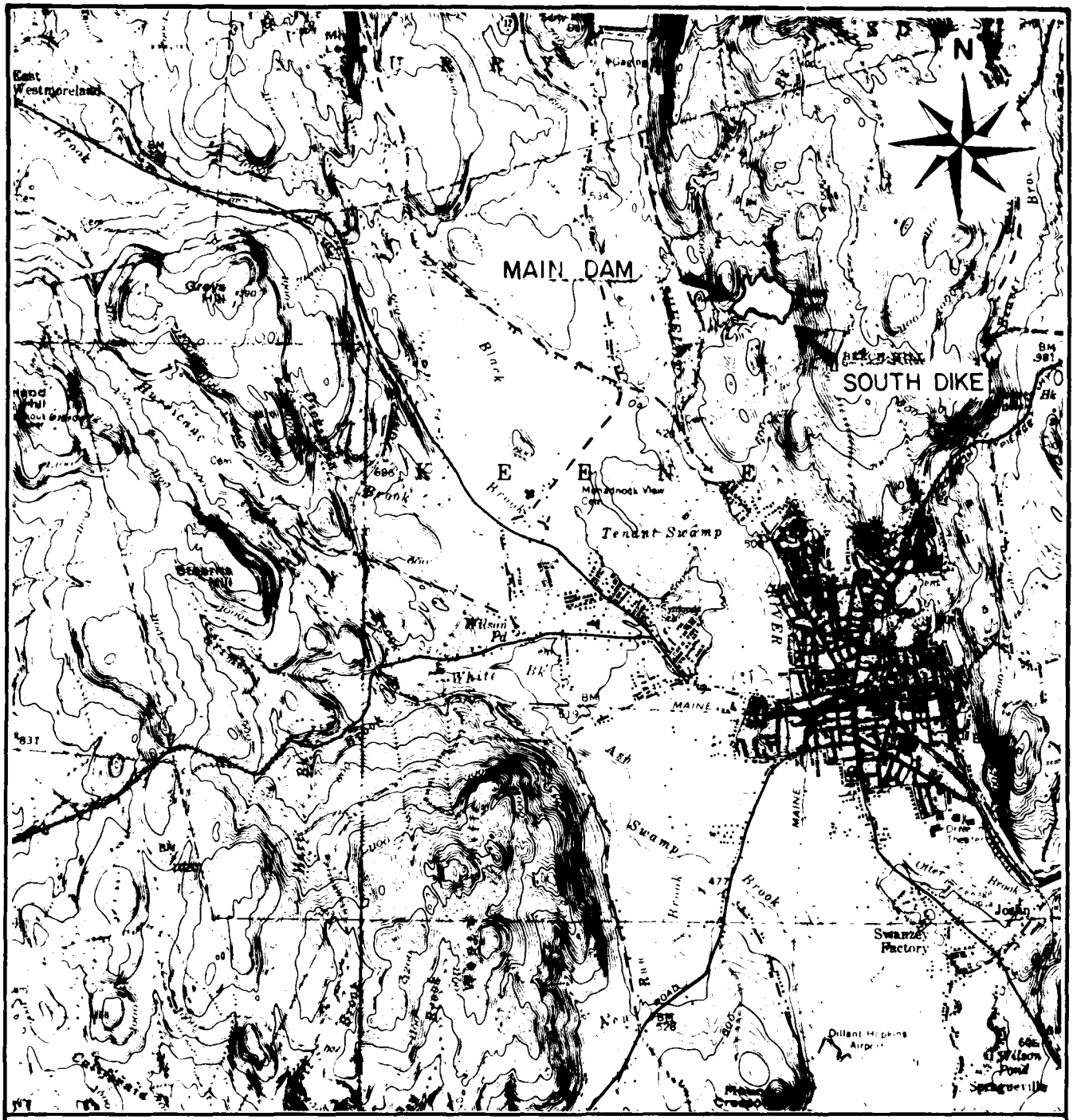


Overview of Main Dam and Gatehouse

Overview of Spillway



Overview of Dike



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FROM: USGS KEENE - N H QUADRANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN

FILE No. 2327

GOOSE POND DAM NEW HAMPSHIRE

SCALE AS NOTED

DATE DECEMBER 1979

PHASE I INSPECTION REPORT

GOOSE POND DAM

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-376, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of October 15, 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-79-C-0058 has been assigned by the Corps of Engineers for this work.

(b) Purpose

(1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

(3) Update, verify, and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.

1.2 Description of Project

(a) Location

The Goose Pond Dam, once called Sylvan Lake Dam, is located on an unnamed brook approximately 3,000 feet upstream of the Ashuelot River in Keene, New Hampshire. It can be reached from an access road off of East Surry Road which intersects state Route 12A north of Keene, New Hampshire. The dam is shown on USGS Keene, New Hampshire Quadrangle, with coordinates approximately at N 42° 58.2', W 72° 17.7' (see location map on Page v) Page B-2 of Appendix B is a site plan for this dam.

(b) Description of Dam and Appurtenances

The dam consists of an earth embankment with a stone corewall and an overflow spillway in natural ground approximately 200 feet to the right of the embankment. The embankment is 210 feet long and the spillway has two bays which are each 11.5 feet wide. There is an earth dike associated with this reservoir. It is located approximately 1,500 feet to the left of the dam.

(1) Dam Embankment (Photos 1,2,3,& 4)

The dam embankment is 210 feet long and a maximum of 23 feet high. The upstream slope is 2.5 horizontal to 1 vertical and is lined with riprap. The downstream slope is 2.5 horizontal to 1 vertical. The crest width is 10 feet. According to available records there is a corewall of stone in this embankment although the depth and type of construction are not known.

(2) Dike Embankment (Photo 13)

The dike embankment is approximately 210 feet long and 6 feet high. The side slopes are approximately 2.5 horizontal to 1 vertical. The crest width is approximately 12 feet. No design or construction records are available to indicate the composition of this embankment. The dike has no outlet works.

(3) Spillway (Photos 8,9 & 10)

The spillway consists of a broad crested weir 24.3 feet long and 15.5 feet wide. The spillway elevation is 2 feet below the top of the dam and 2.5 feet below the top of the dike. A 16 inch intermediate pier is located at mid-length along the crest. Flashboard slots, 3 inches wide and 2 inches deep are cast into this pier. A concrete apron approximately 25 feet long has been constructed as an extension of the spillway. This apron tapers in width to 8 feet at the downstream end and has a slope drop of approximately 3.7 feet in 25 feet.

End walls at both ends of the spillway have been constructed in a V-shaped configuration. The upstream ends of these walls splay into the impoundment pool at an angle of 45° and are 12 feet long. The walls parallel to the spillway axis are 10 feet long and 15 inches wide at the top. Flashboard slots, similar to those in the intermediate pier have been cast into the walls at the spillway interface. Upward sloping concrete aprons have been constructed adjacent to the spillway crest up to the end walls.

(4) Outlet Structure (Photos 5,6 & 7)

This structure, which is constructed with cemented stone masonry, is 11.5 feet square with 14 inch thick walls and a wood framed hip roof. It is located on the upstream slope of the dam. This structure is supported on a concrete slab 15 feet square. This slab is supported on a concrete foundation 3.75 feet below the floor elevation. The inlet of this structure is approximately 30 inches wide with stop log slots.

There is a 24 inch diameter outlet conduit extending under the embankment. The waste gate at the upstream end is closed and all operating mechanisms have been removed.

The waste gate outlet consists of a brick arch approximately 24 inches wide. Its height could not be determined. The outlet terminates at a 6 foot long granite headwall and a 20 foot long training wall on its left side which terminates at a rock outcrop. There is no right training wall.

(5) Foundation and Embankment Drainage

Available data and the visual inspection did not reveal any evidence of a foundation drainage system for the earth embankments associated with this reservoir.

(c) Size Classification

The dam's maximum impoundment of 606 acre-feet and height of 20 feet place it in the SMALL size category according to the Corps of Engineer's Recommended Guidelines.

(d) Hazard Potential Classification

The hazard potential classification for the main dam is HIGH because of potential for loss of life in 60 house trailers which would flood one to four feet. The hazard potential classification for the dike is significant because of potential for minor flooding at two to four houses presently under construction in the event of a failure of this dike.

(e) Ownership

The dam is owned by the City of Keene, New Hampshire. It is overseen by the Department of Public Works, Keene, New Hampshire 03431.

(f) Operator

The operation of the dam is controlled by the Department of Public Works of Keene, New Hampshire. They can be reached by telephone at (603) 352-6550.

(g) Purpose of the Dam

The dam was originally constructed for water supply purposes but it was taken offline approximately 40 years ago. Since that time it has been used for conservation and recreational purposes.

(h) Design and Construction History

The dam was constructed in 1868. A new outlet conduit was installed in 1929. A new spillway was installed in 1946.

(i) Normal Operating Procedure

The dam is normally self regulating. The waste gate is inoperable.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers 1.5 square miles. It is made up primarily of mountainous woodland with some pasture and minor development.

(b) Discharge at Damsite

(1) Outlet Works

The outlet works at this dam consists of a 24 inch diameter outlet conduit equipped with a gate. The gate is inoperable because all the controls have been removed.

(2) Maximum Known Flood

There is no data available for the maximum known flood at this damsite.

(3) Ungated Spillway Capacity at Top of Dam

The capacity of the spillway with the reservoir at top of dam elevation (637 feet NGVD) is 195 cfs.

(4) Ungated Spillway Capacity at Test Flood

The discharge capacity of the spillway at test flood elevation 638.6 is 470 cfs.

(5) Gated Spillway Capacity at Normal Pool

There are no gated spillways. The waste gate is normally closed.

(6) Gated Spillway Capacity at Test Flood

As previously stated, there are no gated spillways.

(7) Total Spillway Capacity at Test Flood

The total spillway capacity at test flood elevation 638.6 is 470 cfs.

(8) Project Discharge at Test Flood Elevation

The total project discharge at test flood elevation (638.6 feet NGVD) is 3,470 cfs.

(c) Elevation (feet NGVD)

(1) Streambed at downstream toe of dam: 613

(2) Maximum tailwater: Unknown

(3) Upstream portal invert diversion tunnel: Not applicable

(4) Normal Pool: 635

(5) Full flood control pool: Not applicable

(6) Spillway crest: 635

(7) Design Surcharge: Unknown

(8) Top of dam: 637
Top of dike: 637.5

(9) Test flood design surcharge: 638.6

(d) Reservoir

(1) Length of maximum pool: 2,400± feet

(2) Length of normal pool: 2,200± feet

(3) Length of flood control pool: Not applicable

(e) Storage (acre-feet)

(1) Normal pool: 522

(2) Flood control pool: Not applicable

(3) Spillway crest pool: 522

(4) Top of dam: 606

(5) Test flood: 670+

(f) Reservoir Surface (acres)

(1) Normal pool: 42

(2) Flood control pool: Not applicable

(3) Spillway crest pool: 42

(4) Test flood: 43+

(5) Top of dam: 42+

(g) Dam

(1) Type: Earth embankment (main dam and dike)

(2) Length: 210 feet (dam)
210 feet (dike)

(3) Height: 23 feet (dam)
6 feet (dike)

(4) Top width: 10 feet (dam)
12 feet (dike)

(5) Side slopes: 2.5 horizontal to 1 vertical (dam and dike)

(6) Zoning: Unknown

(7) Impervious core: Records indicate a stone corewall in the dam, dike is unknown

(8) Cutoff: Unknown

(9) Grout curtain: None

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillway

(1) Type: Two broad crested concrete weirs

(2) Length of weir: 23 feet (2 weirs of 11.5' each)

(3) Crest elevation: 635 feet NGVD

(4) Gates: None

(5) Upstream channel: Reservoir

(6) Downstream channel: Narrow channel through wooded slope

(j) Regulating Outlet

The only regulating outlet is a 24 inch diameter outlet conduit which is equipped with a waste gate. This gate is inoperable at the present time. Available records indicate that the invert of this gate is at elevation 614±.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No design drawings or calculations are available for this dam. Significantly lacking are data concerning the length and depth of the stone corewall, the character of the earth embankments and the foundation conditions.

2.2 Construction Data

No construction records are available for this dam.

2.3 Operational Records

No operational records are available for this dam.

2.4 Evaluation of Data

(a) Availability

The absence of design drawings and calculations is a significant shortcoming. An overall unsatisfactory assessment for availability is therefore warranted.

(b) Adequacy

The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from the standpoint of reviewing design and construction data. This assessment of the dam is thus based primarily on the visual inspection, past performance, and sound engineering judgment.

(c) Validity

Since the observations of the inspection team generally confirm the available data, a satisfactory evaluation for validity is indicated.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Goose Pond Dam is in FAIR condition at the present time.

(b) Dam

(1) Main Dam Embankment (Photos 1,2,3 and 4)

The alignment of the dam along the crest is generally good to slightly irregular. There is no evidence of movement of the crest.

The riprap on the upstream slope is in FAIR to GOOD condition with no major problems existing. Above the water line there is heavy grass growth and there are two large trees growing on the upstream slope near the left abutment. There is one small tree growing to the right of the gatehouse.

The downstream slope is covered with a heavy growth of trees up to 3 feet in diameter. There are 25 to 30 trees greater than one foot in diameter and approximately 20 less than one foot in diameter. There is a shallow eroded path on the downstream slope (Photo 4). There is a wet area along the downstream toe approximately 20 feet to the left of the outlet conduit. There was no visible flow noted.

(2) Dike Embankment (Photo 13)

The alignment of the dike is good with no evidence of movement of the crest. There are two trees larger than one foot in diameter and approximately 30 smaller trees growing on the upstream slope. There are 10 to 15 trees larger than one foot in diameter and approximately 30 smaller trees growing on the downstream slope.

There are numerous wet areas within 20 feet of the downstream toe of the embankment. These areas occur at elevations higher than the water level in the downstream swamp and lower than the pond. They appear to be signs of seepage through the dike but seepage from higher natural ground to the west of the dike cannot be discounted.

(3) Spillway (Photos 8,9,10 and 11)

The spillway and the end walls are in fair condition at the present time. Seepage is encountered at the approximate rate of 15 to 20 gallons per minute at the downstream end of the concrete apron adjacent to its right side. (Photo 11) The intermediate pier is in good condition with the exception of minor surface erosion at its interface with the spillway. This can be attributed to ice damage. The spillway crest is in fair condition with the exception of transverse cracks and exposed aggregate on its surface. The downstream apron has two longitudinal cracks approximately ½ inch in width which can be attributed to shrinkage. The concrete in this apron was hand placed without the benefit of screeds. There is debris both immediately upstream and immediately downstream of the spillway.

(4) Outlet Structure (Photos 2,5,6 and 7)

The gatehouse stone walls and concrete slab and foundation are in good condition. The roof is in complete disrepair. The asphalt shingles are randomly patched with roofing paper. The original access manhole has been permanently sealed with concrete. This activity occurred between March 1979 and prior to August 21, 1979. The entrance door is in complete disrepair. All operating equipment has been removed from within the structure. Stop logs are in place at the upstream end of the structure and are set to an elevation approximately 3 feet below the water surface elevation. This structure has been abandoned.

The outlet conduit and the dry masonry headwall and training wall are in fair condition. Approximately 5 to 10 gpm is flowing through this conduit which can be attributed to improper seating of the abandoned sluice gate. There is some brush and debris in the channel immediately downstream (Photo 7).

(c) Reservoir Area (Overview Photos)

The shore of the reservoir is generally shallow sloping woodland. It appears stable and in good condition.

(d) Downstream Channel (Photos 10 and 12)

The channel downstream of the dam joins the spillway channel before the confluence with the Ashuelot River. They are natural streambeds over gently sloping, wooded terrain. They appear stable and in good condition except for debris in channels near the dam and the spillway.

3.2 Evaluation

The dam and its appurtenances are in FAIR condition at the present time. The potential problems observed during the visual inspection are listed below:

(a) Heavy tree growth on both embankments.

(b) Possible seepage areas downstream of both embankments.

(c) Seepage beneath concrete spillway slab.

(d) Gatehouse in disrepair.

(e) Wastegate inoperable.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Operational Procedures

No written operation procedures exist for this dam. It is normally self regulating.

4.2 Maintenance of Dam

No maintenance program exists for this dam.

4.3 Maintenance of Operating Facilities

No maintenance program exists for this dam.

4.4 Description of Warning System

There is no warning system in effect.

4.5 Evaluation

The present maintenance and operating policy is not satisfactory for continued long-term use of the dam. A formal written warning system is recommended because of the possibility of loss of lives and damage to downstream structures in the event of a dam failure.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

(a) General

Goose Pond Dam is an earth embankment on an unnamed tributary of the Ashuelot River, which is a tributary of the Connecticut River. The dam is located about 4,000 feet upstream of the confluence of the unnamed brook and the Ashuelot River, which is about three miles upstream of the center of Keene.

Goose Pond is formed by two embankments - the main dam and a dike. The main dam is a 210 foot long, 23 foot high earth embankment. There is one gate which is no longer operable. The spillway is two 11.5 foot long broad-crested concrete weirs with crests 2 feet below the dam crest. The dike is a 210 foot long, 6 foot high earth embankment with no outlet.

(b) Design Data

Data sources available for Goose Pond Dam include prior inventory and inspection reports. Much of the basic data for the dam is contained in the New Hampshire Water Control Commission's "Data on Dams in New Hampshire" (December 27, 1938), and the New Hampshire Water Resources Board's "Inventory of Dams and Water Power Developments" (October 6, 1937). Inspection reports dated June 15, 1930; October 16, 1975; and November 16, 1976 are on record, as is 1947 correspondence between the New Hampshire Water Resource Board and the City of Keene regarding the dam's limited spillway capacity. Correspondence in 1977 regarding dam maintenance measures is also available.

(c) Experience Data

No records of flow or stage are known to be available for Goose Pond Dam.

(d) Visual Observations

The Goose Pond Dam spillway has two broad crested concrete weir bays, each 11.5 feet long at elevation 635 feet NGVD, 2 feet below the dam crest. The channel below the spillway is separate from the main dam channel for about 1,500 feet before the channel converge.

The only controlled outlet at Goose Pond Dam is a waste gate leading to a conduit under the dam. This gate is closed and is no longer operable. The operating mechanisms have been removed.

The dike separates Goose Pond from a swamp which is on another unnamed tributary of the Ashuelot. This swamp has an area of about 20 acres and extends for some 1,200 feet to the beginning of a small brook. This brook runs through some 4,800 feet of undeveloped land before reaching a small pond. Several* houses under construction near the pond inlet are 3 to 4 feet above the pond surface, and four existing houses near the outlet are 8 to 9 feet up.

There is a second small pond immediately downstream, which is formed behind a 10 foot by 12 foot culvert under Route 12-A. 1,500 feet beyond Route 12-A, this brook flows into the Ashuelot River.

The first development downstream of the main dam is at East Surry Road, about 2,000 feet away. This road crosses the stream on an earth embankment with a four foot by four foot culvert. There is a house just upstream of the road 14 feet above the streambed.

After passing East Surry Road the brook runs about 1,700 feet to the Ashuelot River. About 3,200 feet downstream from the mouth of the brook on the Ashuelot is a trailer park with about 60 trailers in the flood plain 7 to 10 feet above the river bed. This trailer park is just downstream of the Court Street bridge, which is the only other development in the reach.

(e) Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to safely allow an appropriately large flood to pass. This requires use of the discharge and storage characteristics of the structure to evaluate the impact of an appropriately sized test flood. None of the original hydraulic and hydrologic design records are available for use in this study.

---

* There are 2 to 4 houses currently under construction. This area appears to be undergoing rapid development, and additional houses may be added in the near future.

Guidelines for establishing a recommended test flood based on the size and hazard classification of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of less than 1,000 acre-feet and the height of less than 40 feet classify this dam as a SMALL structure.

The hazard classification for this dam is HIGH because of the significant economic losses and potential for loss of life downstream in the event of failure of the dam. As shown in the Dam Failure Analysis section, the increase in flooding caused by failure would pose a threat to property and to lives at the trailer park on the Ashuelot River in the City of Keene.

As shown in Table 3 of the "Recommended Guidelines", the appropriate Test Flood for a dam classified as SMALL in size with a HIGH hazard potential would be between one-half the probable maximum flood (PMF) and the PMF. Since the risk downstream in the event of dam failure is quite high, the PMF is the adopted Test Flood. Use of "Maximum Probable Flood Peak Flow Rates" for mountainous terrain and a drainage area of 1.5 square miles yields a peak PMF inflow of 2,550 csm, or 3,825 cfs. Determination of attenuation due to storage in the reservoir results in a Test Flood routed peak outflow of 3,470 cfs with the water surface at about 638.6 feet MSL. This is 1.6 feet above the main dam crest. 3.6 feet above the spillway crest, and 1.1 feet above the South Dike crest.

Goose Pond Dam would be severely overtopped by the PMF Test Flood. Even the estimated 100-year peak outflow of 330 cfs is 72 percent greater than the spillway capacity of 195 cfs with the water surface at the dam crest. At the one-half PMF outflow of about1,600 cfs, the water surface would be about 0.9 feet above the dam crest.

(f) Dam Failure Analysis

The dam failure analysis for Goose Pond Dam includes analysis of the effects of failure of the main dam and/or dike. The peak outflows that would result from the failure of the main dam and the dike of Goose Pond Dam are estimated using the procedures suggested in "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs". In each case failure is assumed to occur with the water surface elevation at the embankment crest.

(1) South Dike

For this dike the assumed water surface elevation at failure is 637.5 feet NGVD, 2.5 feet above the spillway crest. There is no outflow at the south dike at this elevation.

For the assumed breach width equal to 40 percent of the embankment width at the half-height, the gap in the dike due to failure would be 75 feet. Given the 6 foot height above tailwater, the resulting peak dam failure outflow would be 1,850 cfs.

This flows into a swamp with a surface area of about 20 acres. Assuming that the swamp's outlet controls flows downstream, the peak failure flow downstream is estimated as 440 cfs.

The first development downstream of the swamp impacted by dam failure flows would be the houses around a small pond in North Keene, 4,800 feet downstream of the swamp's outlet. The pond is created by a 30 foot long, 15 foot high masonry dam with a 5 foot spillway and 2 feet of freeboard. There are several houses around the pond, several under construction 3 to 4 feet above the spillway crest, and four 8 to 9 feet up.

If the masonry dam were to hold under the dam failure flow of 440 cfs, the stage would be 4.3 feet over the spillway crest and 2.3 feet above the dam crest. This would cause minor flooding at the houses under construction, and would probably not cause serious damage.

Whether or not dam failure flows from the dike caused dam failure at this small pond, the resulting outflow would not cause significant flooding downstream in the 1,500 feet to the Ashuelot River. The brook passes under Route 12-A through a 10 foot by 12 foot box culvert and by the Cheshire Hospital in this reach, but both the highway and the hospital are above flood flow levels.

(2) Main Dam

For the main dam the assumed water surface elevation at failure is 637 feet NGVD, 2 feet above the spillway crest. The spillway outflow at this elevation is about 200 cfs, which flows in a channel separate from that below the dam for 1,500 feet. There is no discharge prior to dam failure to the channel below the dam.

For an assumed breach width equal to 40 percent of the dam width at the half-height, the gap in the dam due to failure would be 40 feet. The resulting peak failure outflow would be 7,400 cfs given the 23 foot embankment height.

This flow would not attenuate significantly in the 2,000 feet to East Surry Road, the first downstream development. The contribution of spillway flow would increase the peak flow at East Surry Road to 7,600 cfs. The road crosses the brook on an 8 foot embankment with a 4 foot by 4 foot culvert. If the embankment did not fail, the peak stage generated by 7,600 cfs of flow would be 14 feet above the streambed, 6 feet above the road. This is below the living area of a house upstream of the road. If the embankment were to fail under the flow, the peak stage would be lower.

Downstream of East Surry Road, the brook runs 1,700 feet to the Ashuelot River. There is no development threatened by flooding in this reach, and the peak failure flow would not be significantly attenuated.

Peak dam failure flows would begin to attenuate in the Ashuelot, which is a larger stream than the brook. Assuming that flow in the river is insignificant compared to the peak failure inflow from the brook of 7,600 cfs, an attenuated peak flow of about 5,500 cfs would occur at the first downstream development, a trailer park with 60 trailers 7 to 10 feet above the river bed. This flow would create a stage of 11 feet at the trailers, causing 1 to 4 feet of flooding at the various trailers. This would cause significant property damage and present a serious threat of loss of life. Large pre-failure flows on the river would worsen this flooding condition. (The 100-year flood on the Ashuelot River as determined in the flood insurance study is about 2,200 cfs).

Downstream of the trailer park, the Ashuelot River flood plain is relatively undeveloped - except for some residences on the fringe of the 100-year flood plain - for the 14,000 feet (±) down to Faulkner and Colony Dam in Keene. In this winding, flat reach with an extensive flood plain, dam failure flows from Goose Pond Dam should largely attenuate. Although some damage might occur in central Keene downstream of the Falukner and Colony Dam, further major flooding is not likely.

The chart on the following page summarizes the downstream effects of the failure of Goose Pond Dam or the south dike. These locations are shown on Page D-32 of Appendix D.

IMPACT OF DAM FAILURE

Location and Number (see Page D-32 Appendix D	Distance Downstream of Dam or South Dike (ft)	Number of Dwellings & Distance above Streambed (ft)	Flow & Stage Before Failure	Flow & Stage After Failure	Comments
Main Dam					
Tailwater	----	----	----	7400 cfs	
1. East Surry Road	2000	Rd. at 8 ft. 1 house at 14 feet	200 cfs 8 feet	7600 cfs 14 feet	14 ft. if roadway holds, which is not likely. Probable damage to road.
Confluence with Ashuelot	3700	----	200 cfs ----	7600 cfs ----	
2. Trailer Park	6900	60 trailers at 7-10 ft.	* *	5560 cfs 11 feet	Severe flooding, high possibility of loss of life. Ashuelot could add to problem if already at high flow.
Downstream of Trailer Park	7000+		----	----	14,000 ft to Keene center. Probably attenuated without additional major damage.

* Assumed negligible compared to failure flows

IMPACT OF DAM FAILURE -(cont.)

Location and Number (see Page D-32 Appendix D	Distance Downstream of Dam or South Dike (ft)	Number of Dwellings & Distance above Streambed (ft)	Flow & Stage Before Failure	Flow & Stage After Failure	Comments
South Dike					
3. Small Pond	6000	Dam, and 2-4 houses under construction 3 feet above s/w crest. May be more in the future.	----	440 cfs 4 feet over s/w crest.	Slight flooding at houses if dam holds. 2 ft. flow over dam crest-possible failure. No development threatened downstream.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

The field investigations revealed no significant displacement of distress which would warrant the preparation of structural stability calculations, based on assumed sectional properties and engineering factors.

(b) Design Construction Data

There are no plans or calculations of value to a stability assessment available for this dam.

(c) Operating Records

There are no known operating records for this dam.

(d) Post Construction Changes

Since the original construction of the dam a new outlet conduit was installed in 1929, and a new spillway was installed in 1946.

(e) Seismic Stability

The dam is located in Seismic Zone No. 2 and in accordance with the recommended Phase I Guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The Goose Pond Dam is in FAIR condition at the present time.

(b) Adequacy of Information

The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from the standpoint of reviewing design and construction data. This assessment is based primarily on the visual inspection, past performance, and sound engineering judgement.

(c) Urgency

The recommendations and improvements contained herein should be implemented by the owner within one year of receipt of the Phase I Report.

7.2 Recommendations

It is recommended that the owner retain a qualified registered engineer for the following services:

- Hydrologic and hydraulic studies to determine the need for additional project discharge capacity.
- Determination of the source of the wet areas downstream of the toe of the dam and dike; the cause of the seepage at the spillway apron; and recommendations to remedy these problems.
- Recommendations for the careful removal of trees, shrubs, and saplings, including their roots, from the slopes of the embankments, and for backfilling the resulting voids.

The owner should implement the finding of these studies.

7.3 Remedial Measures

It is recommended that the owner institute the following remedial measures:

(1) Rehabilitate or replace the waste gate and controls.

(2) Repair the gatehouse structure.

(3) Clear debris from spillway, downstream spillway channel, and channel immediately downstream of the main dam.

(4) Implement and intensify a program of diligent and periodic maintenance including, but not limited to: mowing embankment slopes, backfilling drainage gullies or animal burrows with suitable, well tamped soil, and clearing debris from outlets and slopes.

(5) Implement a program of annual technical inspections of the dam and its appurtenances including operation of all outlet works.

(6) Develop a plan for surveillance of the dam during and immediately after periods of heavy rainfall and for warning downstream officials in the event of an emergency.

7.4 Alternatives

Breaching the dam is one possible alternative to the above measures.

APPENDIX A

INSPECTION CHECKLIST

INSPECTION TEAM ORGANIZATION

Date: August 21, 1979

Project: NH00101
Goose Pond Dam
Keene, New Hampshire
NHWRB 126.03

Weather: Clear, Sunny, 75°

INSPECTION TEAM

Nicholas A Campagna*	Goldberg, Zoino, Dunnicliff & Assoc., Inc.(GZD)	Team Captain
William S. Zoino	GZD	Soils
M. Daniel Gordon	GZD	Soils
Jeffrey M. Hardin*	GZD	Soils
Andrew Christo	Andrew Christo Engineers (ACE)	Structures
Paul Razgha	ACE	Structures
Carl Razgha	ACE	Structures
Richard Laramie*	Resource Analysis, Inc. (RAI)	Hydrology
Tom Gooch*	RAI	Hydrology

Owner's Representative Present

Mr. Douglas DeMilio, Department of Public Works
Mr. Al Merryfield, Department of Public Health
Mr. Brian Matson, Department of Parks and Recreation

* The dike associated with this pond was inspected by these persons on October 23, 1979.

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
DAM EMBANKMENT		
Crest elevation	NAC	637 feet (NGVD)
Current pool elevation		635 feet (NGVD)
Maximum impoundment to date		No data
Surface cracks		None
Pavement condition		Not applicable
Movement or settlement of crest		None
Lateral movement		None
Vertical Alignment		Good
Horizontal Alignment		Good
Conditions at abutment and at concrete structures		Good
Indications of movement of structural items on slopes		None
Trespassing on slopes		25 to 30 large (1 to 3 feet) trees on downstream slope, 2 on upstream slope
Sloughing or erosion of slopes or abutments		Shallow eroded path down the downstream slope
Rock slope protection - riprap failures		Riprap on upstream slope in fair condition
Unusual movement or cracking at or near toes		None
Unusual embankment or downstream seepage	NAC	Wet area 20 ft. left of outlet pipe at downstream toe. No visible flow.

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
Piping or boils	NAC	None
Foundation drainage features		None
Toe drains		None
Instrumentation systems		None
DIKE EMBANKMENT		
Crest elevation		637.5 feet (NGVD)
Current pool elevation		635.0 feet (NGVD)
Maximum impoundment to date		No data
Surface cracks		None
Pavement condition		Not applicable
Movement or settlement of crest		None
Lateral movement		None
Vertical alignment		Good
Horizontal alignment		Good
Condition at abutment and at concrete structures		Good
Indications of movement of structural items on slopes		None
Trespassing on slopes		10 to 50 trees on upstream and downstream slopes, 1/2 to 2 foot diameter
Sloughing or erosion of slopes or abutments	NAC	None

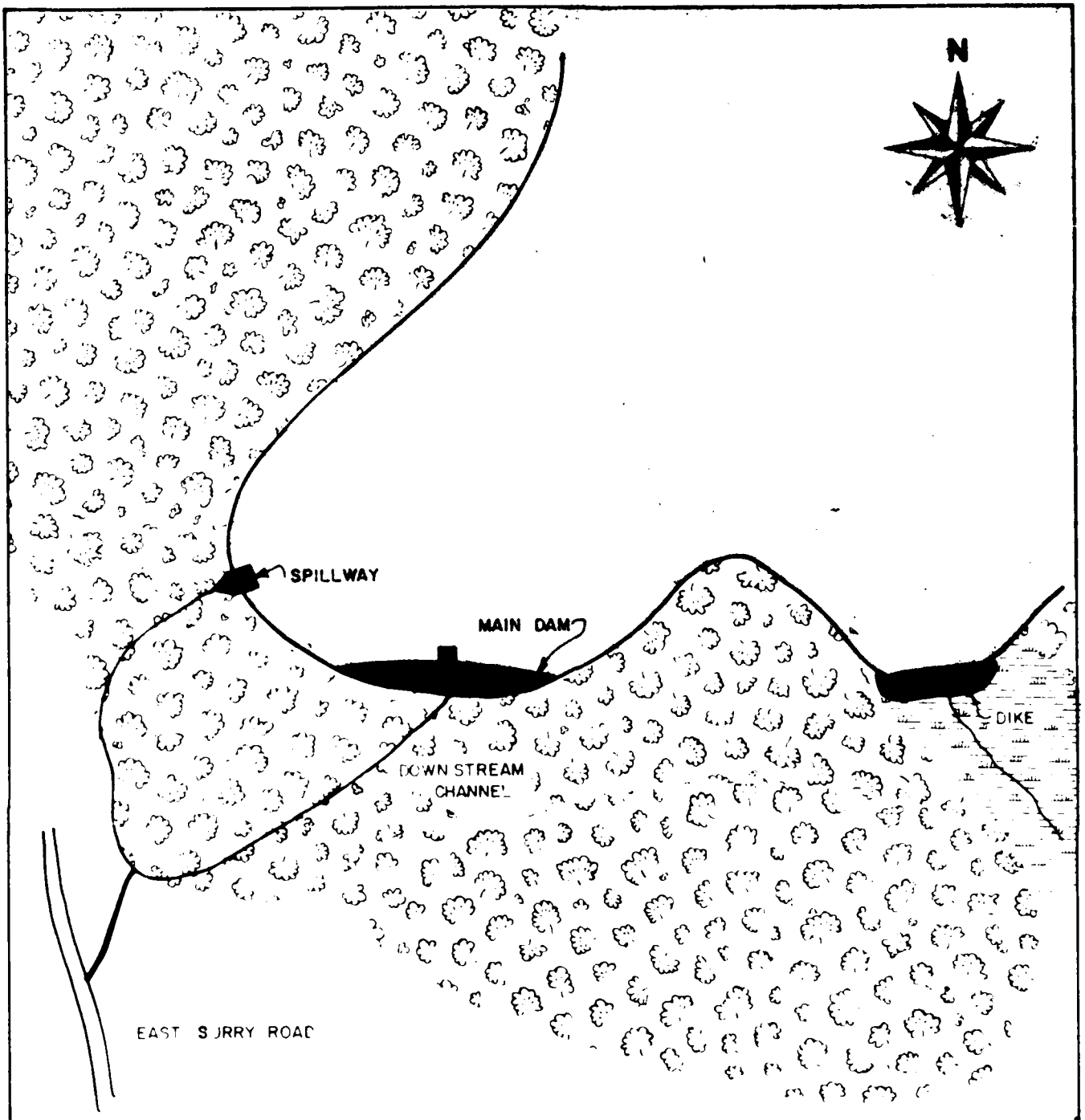
CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
Rock slope protection - riprap failures	NAC	None, upstream slope in good condition
Unusual movement or cracking at or near toes		None
Unusual embankment or downstream seepage		2 wet areas along downstream toe at right side of embankment
Piping or boils		None
Foundation drainage features		None
Toe drains		None
Instrumentation systems	NAC	None
SPILLWAY		
Condition of Concrete	PR	Fair
Spalling		None
Erosion		Minor surface erosion
Cracking		Minor transverse cracks on crest. Two longitudinal cracks ¼" wide on downstream apron.
Rusting or staining of concrete		None
Visible reinforcing		None
Efflorescence		None
Seepage	PR	Right side of downstream end of apron 15 to 20 gpm

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
APPURTENANT STRUCTURES		
END WALLS AND PIER		
Condition of concrete	PR	Good
Spalling		None
Erosion		Minor on pier
Cracking		None
Rusting or staining of concrete		None
Visible reinforcing		None
Efflorescence		None
OUTLET STRUCTURE		
GATE HOUSE		
Condition of stone masonry		Good
Condition of concrete		Good without any evidence of spalls, cracks, erosion oe efflorescence
Roofing		Deteriorated
Entrance door		Badly damaged
OUTLET CONDUIT AND WALLS		
Condition		Good
Seepage	PR	5 to 10 gpm flow from outlet conduit

APPENDIX B



GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC GEOTECHNICAL CONSULTANTS NEWTON UPPER FALLS, MASS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SITE PLAN

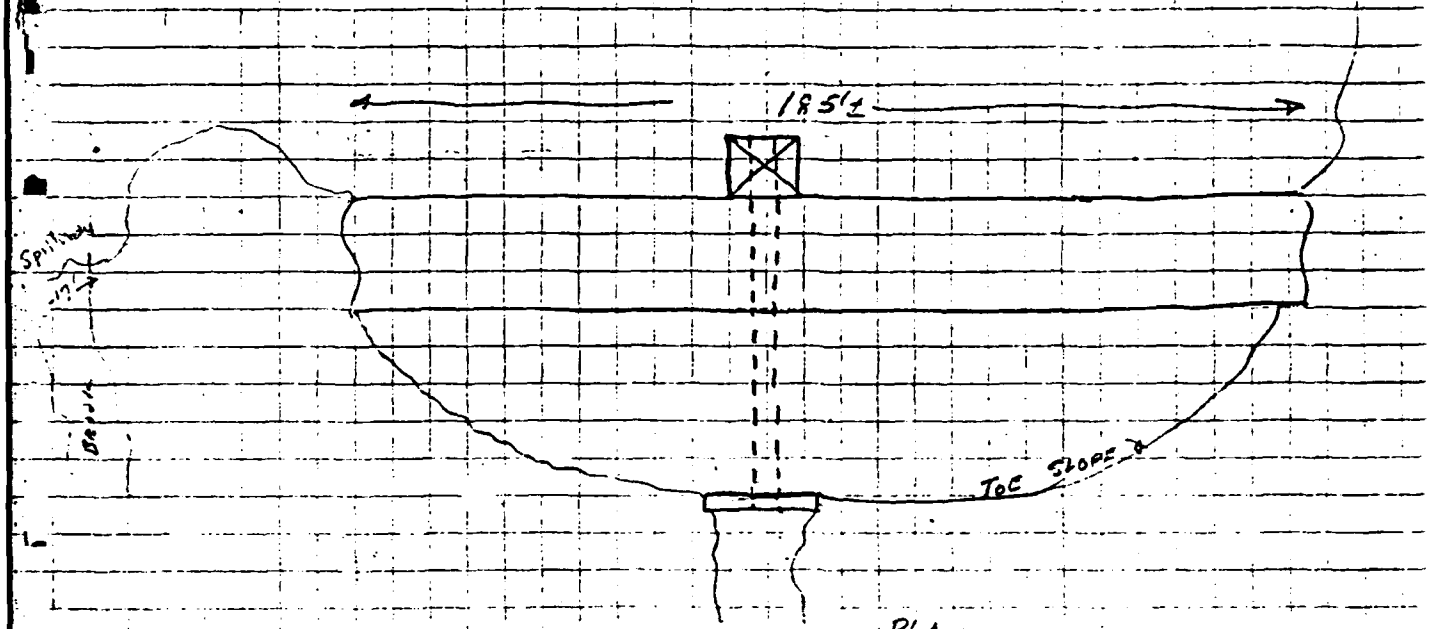
FILE No. 2327

GOOSE POND DAM — KEENE, NEW HAMPSHIRE

SCALE	NO SCALE
DATE	NOVEMBER 1979

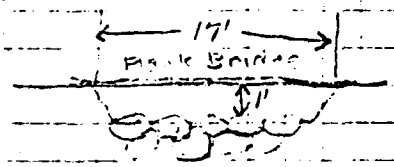
SLYVAN LAKE DAM – KEENE WATER SUPPLY 10/6/37

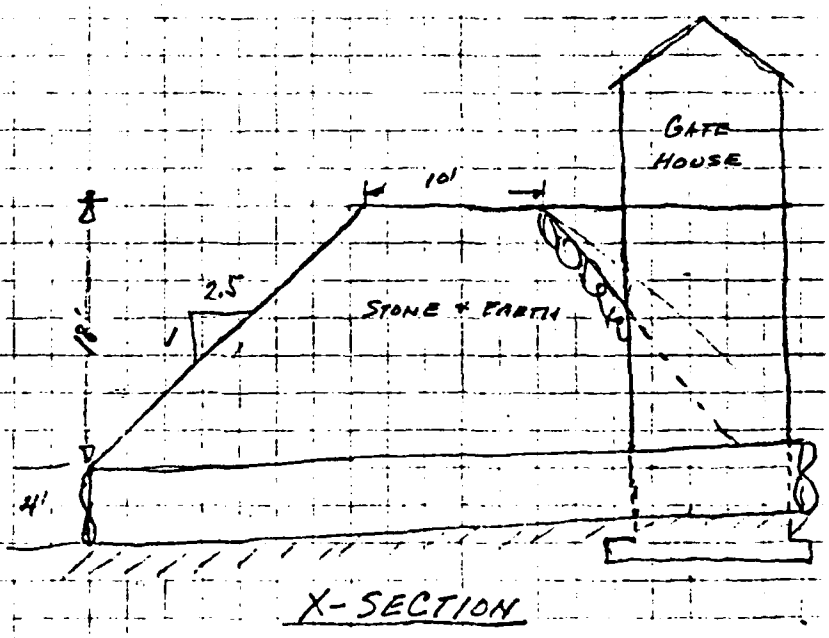
Goose Pond



PLAN

Concrete tile system for emergency use. No way of treating water.





X-SECTION

Keene
Page 4 #5

Inspected June 15, 1930.

Goose Pond Reservoir

Earth dam with a stone core wall. Downstream slope is well grassed over. No sign of leakage. Dam is in good condition. No sign of erosion. New conduit was built in 1929. Superintendent of Water Works, P. F. Babbidge.

DIVI-13.

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 126.03

Town Keene ✓ : County Cheshire

Stream Goose Pond ✓

Basin-Primary Conn R. ✓ : Secondary Ashuelot River ✓

Local Name

Coordinates—Lat. 43° 00' -11,000 : Long. 71° 20' -10,000

GENERAL DATA

Drainage area: Controlled ✓ Sq. Mi.: Uncontrolled Sq. Mi.: Total 1.48 est Sq. M

Overall length of dam 185 ft.: Date of Construction 1868 ✓

Height: Stream bed to highest elev. 22 ✓ ft.: Max. Structure 21' ✓ 20.5 ✓ f

Cost—Dam : Reservoir

DESCRIPTION E Fill rip rap upstream earth & Stone ✓

Waste Gates

Type Waste Pike Pipe

Number 1 : Size ft. high x 4 dia ✓ ft. wid

Elevation Invert 22' ✓ : Total Area sq. f

Hoist (only used in emergency) ✓

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. f

Embankment

Type

Height—Max. ft.: Min. f

Top—Width : Elev. f

Slopes—Upstream on : Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction

Length—Total ✓ ft.: Net 17' ✓ f

Height of permanent section—Max. 21' ft.: Min. 20.5 ✓ f

Flashboards—Type : Height f

Elevation—Permanent Crest : Top of Flashboard

Flood Capacity 75 cfs.: cfs/sq. mi.

Abutments

Materials: ✓

Freeboard: Max. 15' 1.5 ft.: Min. 1.0'± f

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Keene Water Works Keene N H

REMARKS Water Supply

Tabulation By J A N & R L T Date December 27, 1938.

NEW HAMPSHIRE WATER CONTROL COMMISSION

DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 126.03

Town Keene : County Cheshire

Stream Goose Pond

Basin—Primary Conn : Secondary Ashuelot

Local Name

DRAINAGE AREA

Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total ..... Sq. M

ELEVATION vs. WATER SURFACE AREA vs. VOLUME

Point	Head Feet	Surface Area Acres	Volume Acre Ft.
(1) Max. Flood Height			
(2) Top of Flashboards			
(3) Permanent Crest			
(4) Normal Drawdown		42.05	522
(5) Max. Drawdown			
(6) Original Pond	USGS 635		

Base Used .....: Coef. to change to U.S.G.S. Base .....

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	ft.
Volume	ac. ft.	ac. ft.
Acre ft. per sq. mi.		
Inches per sq. mi.		

USE OF WATER Water Supply City of Keene

OWNER Keene Water Works--- Keene N H

REMARKS

(Pond Cap in Gal. 170,000 000)

Tabulation By A A N & R L T Date December 27, 1938.

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Connecticut NO. 3 126.03
RIVER Goose Pond MILES FROM MOUTH 0.6 D.A.SQ.MI
TOWN Keene OWNER City of Keene
LOCAL NAME OF DAM
BUILT 1868 DESCRIPTION Earth fill riprap upstream

POND AREA-ACRES 42.05 P.B. DRAWDOWN FT. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. 22'± MAX. MIN.
OVERALL LENGTH OF DAM-FT. 185' MAX.FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE
TAILWATER ELEV.U.S.G.S. LOCAL GAGE
SPILLWAY LENGTHS-FT. 17' FREEBOARD-FT. 1' to 1.5'
FLASHBOARDS-TYPE,HEIGHT ABOVE CREST
WASTE GATES-NO. WIDTH MAX.OPENING DEPTH SILL BELOW CREST
1 4'D 22'±

REMARKS 2 J Into Nameless Bk, Ashuelot R. Condition good.
Mouth Goose Pond Bk 3.25 mi. from Mouth Ashuelot R.

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Water Supply city of Keene

REMARKS Used only in case of emergency. No provision for treating water by clormation from this pond.
Capacity 170,000,000 gal. Col. Babbidge

DATE 10/6/37 HAS/HS

Jacobson	
Holmgren	K
Colman	
Return to	
Filed	
File No.	

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire

October 13, 1938.

City of Keene,
Keene, N. H.

RE: Goose Pond Dam. W. C. C. No. 136.03

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-24 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. No

2. If so, to what extent? Ans. —

3. Did all flashboards go out? Ans. No flashboards used

4. What was the maximum height of water over the permanent crest of spillway? Ans. 6"

5. At what day and hour did the maximum flood height reach your dam? Ans. Can not say

6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard S. Holmgren

Richard S. Holmgren
Chief Engineer

CDC:GMB
Enc.

January 5, 1977

Keene Water Works
Keene, NH 03431

Gentlemen:

Under the provisions of RSA Chapter 482, Sections 8 through 15, on November 16, 1976 an Eggineer of the Water Resources Board inspected the Goose Pond Dam in Keene. This dam, # 126.03, is classified in the files of this office as a menace structure and as such must be maintained in a manner not to endanger public safety nor become a dam in disrepair.

As a result of this inspection it was noted that several items of maintenance or repair are in need of attention.

1. Debris shall be removed from spillway area. This is to permit the free discharge of water in times of high flow.

2. Trees on the enbankment are to be removed. This is to prevent possible damage to the enbankment or structure by the roots or by an entire tree being uprooted.

Because this dam is classified as a menace structure, we require that you send us a proposed schedule of repairs within thirty (30) days. If you have any questions, please contact us at your convenience.

Very truly yours,

George M. McGee, Sr.
Chairman

GMM:SCB:njk

Enc.

NEW HAMPSHIRE
WATER RESOURCES BOARD

SITE EVALUATION DATA

OWNER: Keene Water Works TELEPHONE NO. _____

MAILING ADDRESS: _____

SITE LOCATION (TOWN OR CITY) Keene

NAME OF STREAM OR WATERBODY: Goose Pond

QUADRANGLE: _____ LOCATION _____

HEIGHT OF (PROPOSED, EXISTING) DAM 22' LENGTH 250

TYPE OF (PROPOSED, EXISTING) STRUCTURE Earth Embankment

DRAINAGE AREA 1.5 Sm POND AREA 42 A

AVAILABLE ARTIFICIAL STORAGE: PERMANENT: _____ TEMPORARY: _____ TOTAL 52

EXISTING DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE

Town Road Several Houses

POTENTIAL DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE _____

POTENTIAL DAMAGE DOWNSTREAM OF STRUCTURE (EXPLAIN IN DETAIL AND INCLUDE ANY POTENTIAL LOSS OF LIFE ESTIMATE) Washout of Town Road damage To Some Houses

OTHER COMMENTS: _____

CLASS OF STRUCTURE -- ~~NON MENACE~~ (MENACE), X (B) X DAM # 125.03

DATE OF INSPECTION: 10-16-75

SIGNED S Burtt
SIGNATURE

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: Keene Dam Number: 126.02

Name of Dam, Stream and/or Water Body: Goose Pond

Owner: Keene Water Works Telephone Number:

Mailing Address:

Max. Height of Dam: 22 Pond Area: 42 Length of Dam: 25

FOUNDATION:

OUTLET WORKS: 2 12' long 1.5' high overfla spillway with Non Failing stop la supports (No Logs in)
2' dia pipe w/ gate operation and

ABUTMENTS:

EMBANKMENT: Earth Embankt 10' wide with Rock 2½:1 slopes

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Freeboard: 1.5

SEEPAGE: Location, estimated quantity, etc.

Changes Since Construction or Last Inspection:

Tail Water Conditions:

Overall Condition of Dam: Good

Contact With Owner:

Date of Inspection: 11-16-78 Suggested Reinspection Date 1980

Class of Dam: Minor B

Signature S Burnett

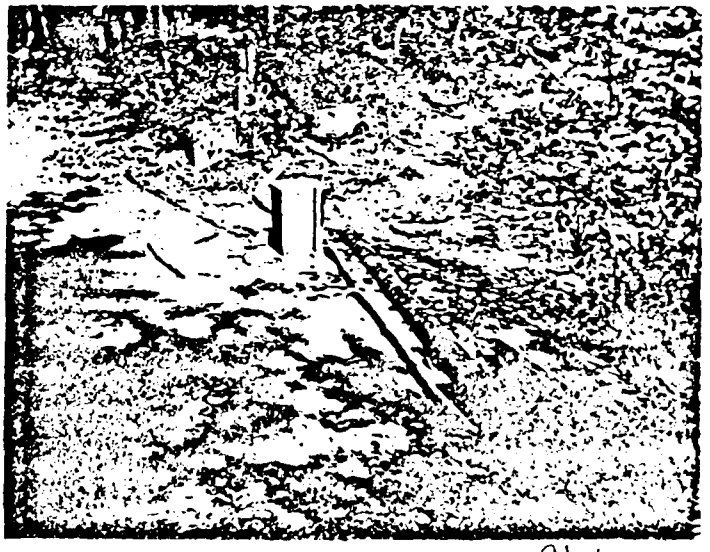
Date

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No. _____

COMMENTS: Trees on Embankment
debris in spilling

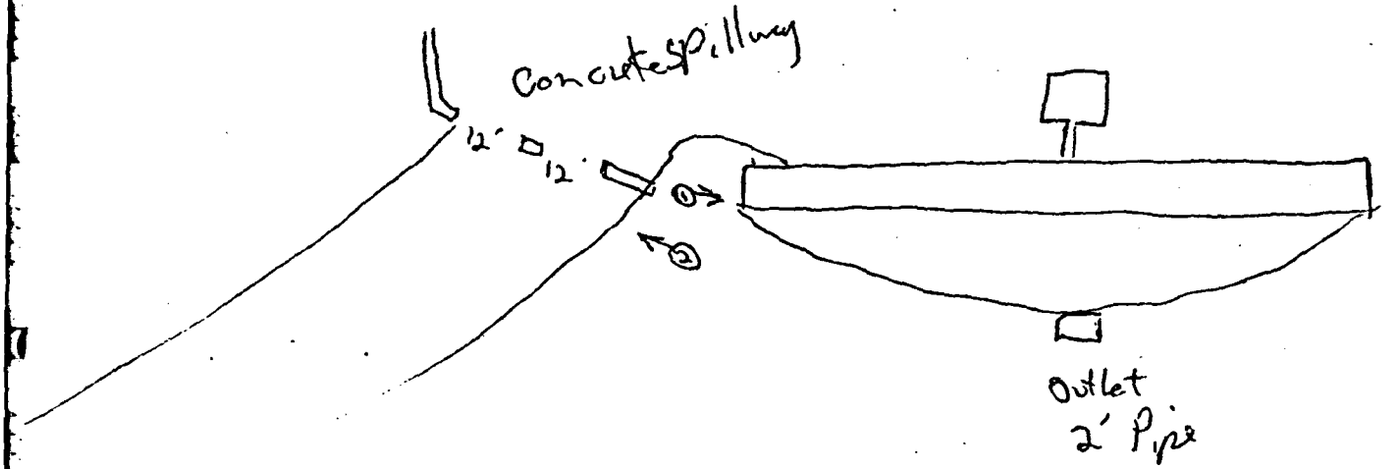
126.03 Photo 1



126.03 Photo 2

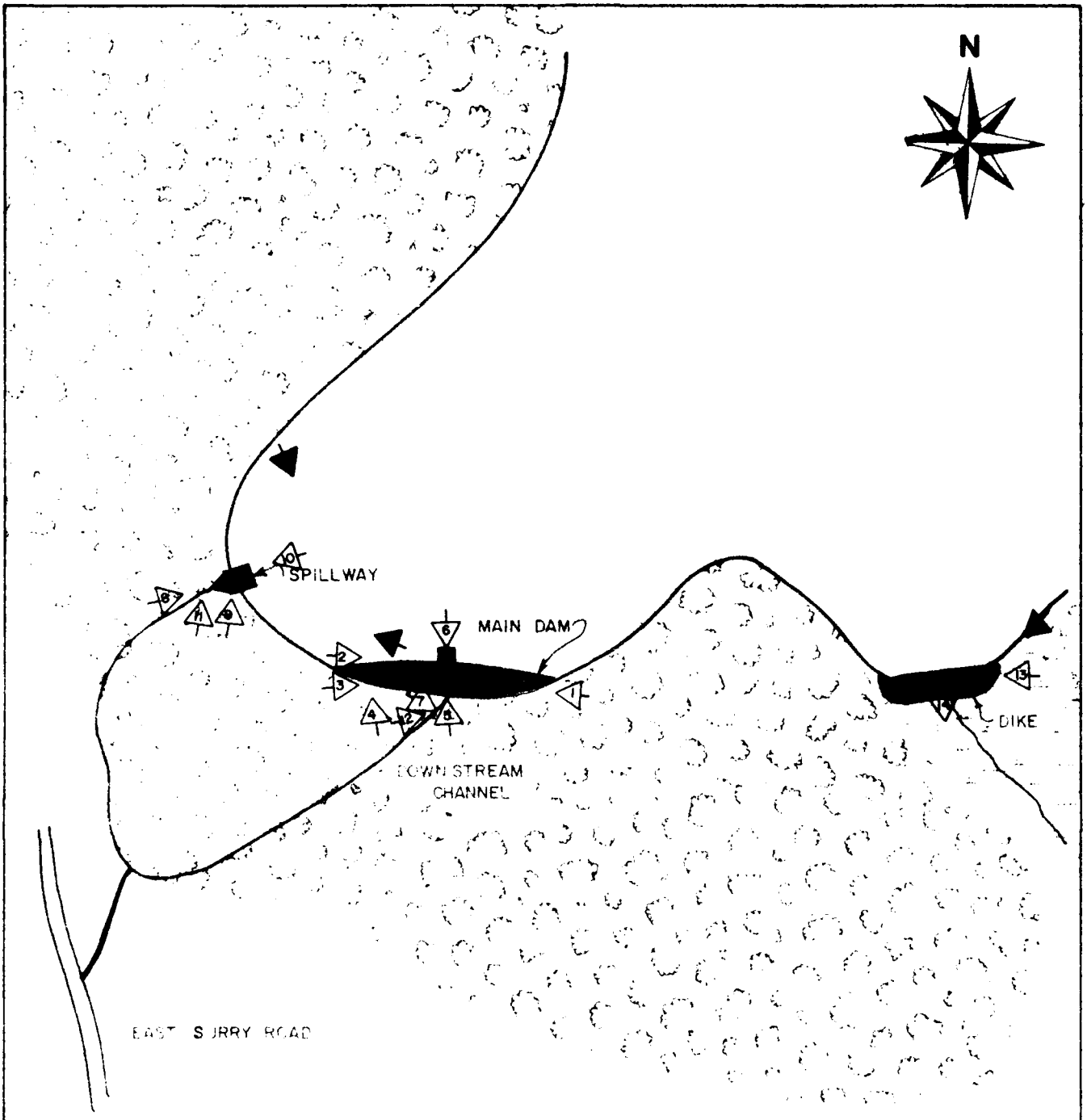
Dam No._____

SKETCH OF DAM (Show Plan, Elevation & Cross Sections)



APPENDIX C

PHOTOGRAPHS



OVERVIEW

APPENDIX C

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC GEOTECHNICAL CONSULTANTS NEWTON UPPER FALLS, MASS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND ORIENTATION OF PHOTOS

FILE No. 2327

GOOSE POND DAM — KEENE, NEW HAMPSHIRE

SCALE NO SCALE

DATE NOVEMBER 1979

1. Crest of Dam from Left Abutment

2. Crest of Dam and Gatehouse from Right Side

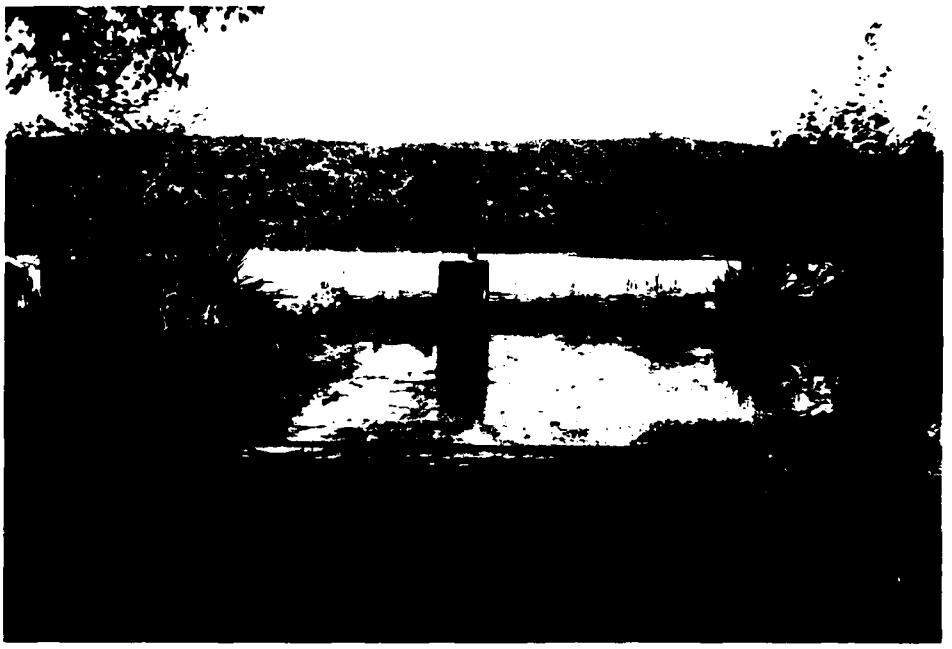
3. Trees on Downstream Slope of Main Dam

4. Eroded Path on Downstream Slope of Main Dam

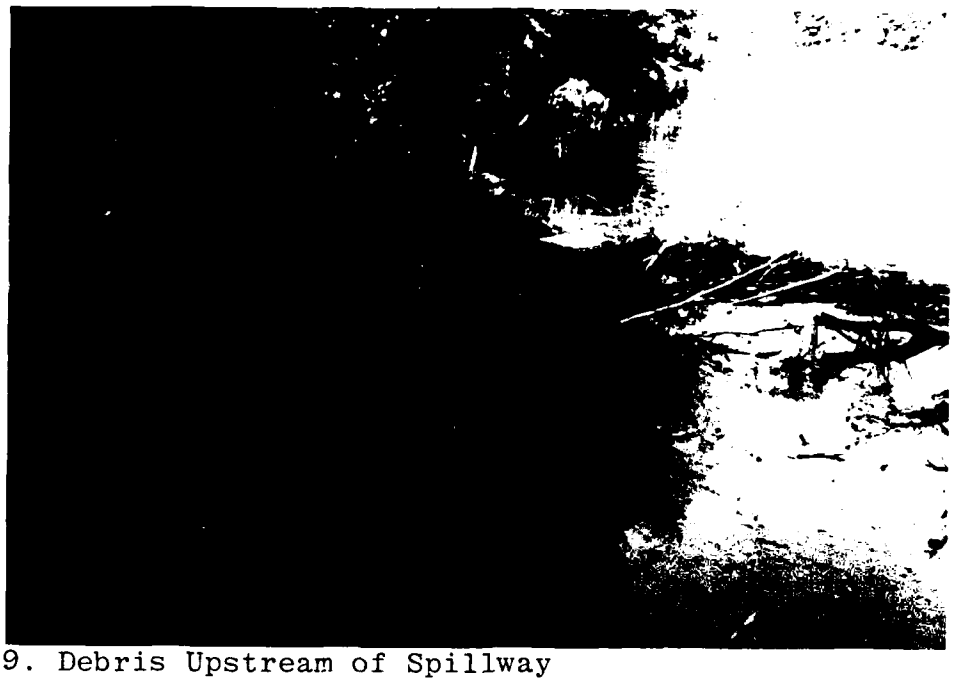
5. Interior of Gatehouse - Sealed Manhole & Controls Removed

6. Gatehouse Intake

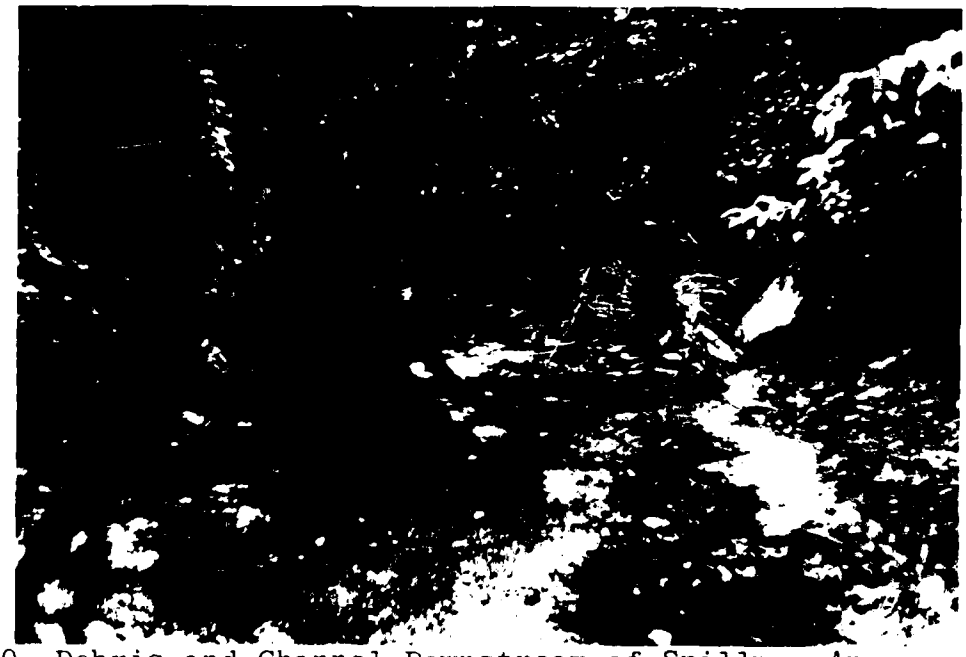
7. Downstream End of Outlet Conduit with Headwall and Training Wall



8. Spillway



9. Debris Upstream of Spillway



10. Debris and Channel Downstream of Spillway Apron

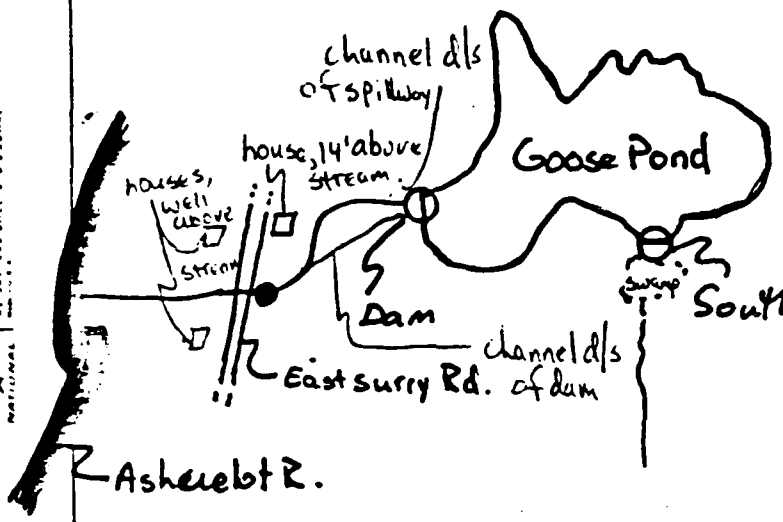
11. Seepage Under Spillway Slab
Right Downstream Side

12. Channel Downstream of Main Dam

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

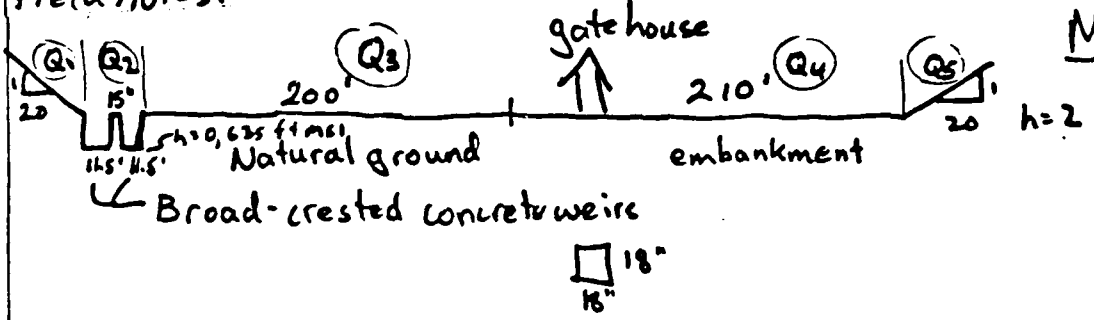
This sketch of Goose Pond Dam & vicinity is based on field notes & U.S.G.S. topo information.

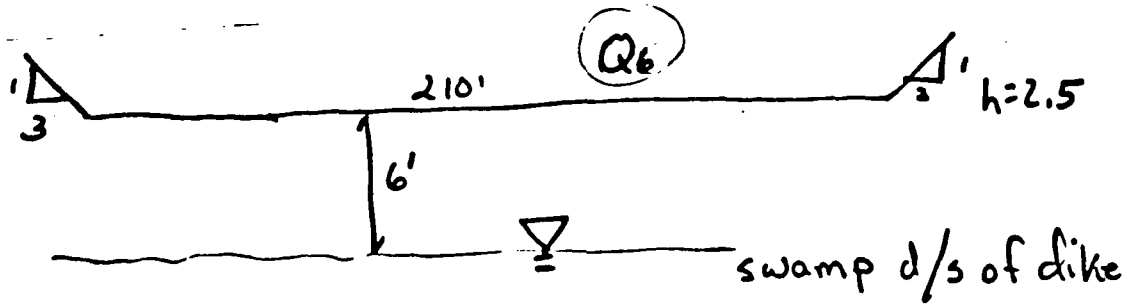


NOT to SCALE

The information used to establish the following elevation of the main dam and south dike was established from field notes.

Main Dam





South Dike

The 18" sq. gate was leaking slightly (<1 cfs) at the time of inspection. For these stage-discharge calculations, it will be assumed to be closed.

Stage-discharge curve

$h < 0$ $Q_1 = Q_2 = Q_3 = Q_4 = Q_5 = Q_6 = 0$

$0 \le h \le 2$

$Q_2 = 3.0\,(23)\,h^{3/2}$

all others unchanged

C = 3.0 for Broad-crested concrete weir

$2 \le h \le 2.5$

$Q_1 = Q_5 = 2.8\,(20(h-2))\,(.5(h-2))^{3/2}$

$Q_2 = 3.0(23)\,h^{3/2} + 3.0(1.25)(h-2)^{3/2}$

C = 2.8 for B-C earth weir

$Q_3 = 2.8(200)\,(h-2)^{3/2}$

$Q_4 = 2.8\,(210)\,(h-2)^{3/2}$

all others unchanged

$h \ge 2.5$ $Q_6 = 2.8\,(210)\,(h-2.5)^{3/2} + 2\,(2.8)(3)(h-2.5)(.5h-25$

all others unchanged.

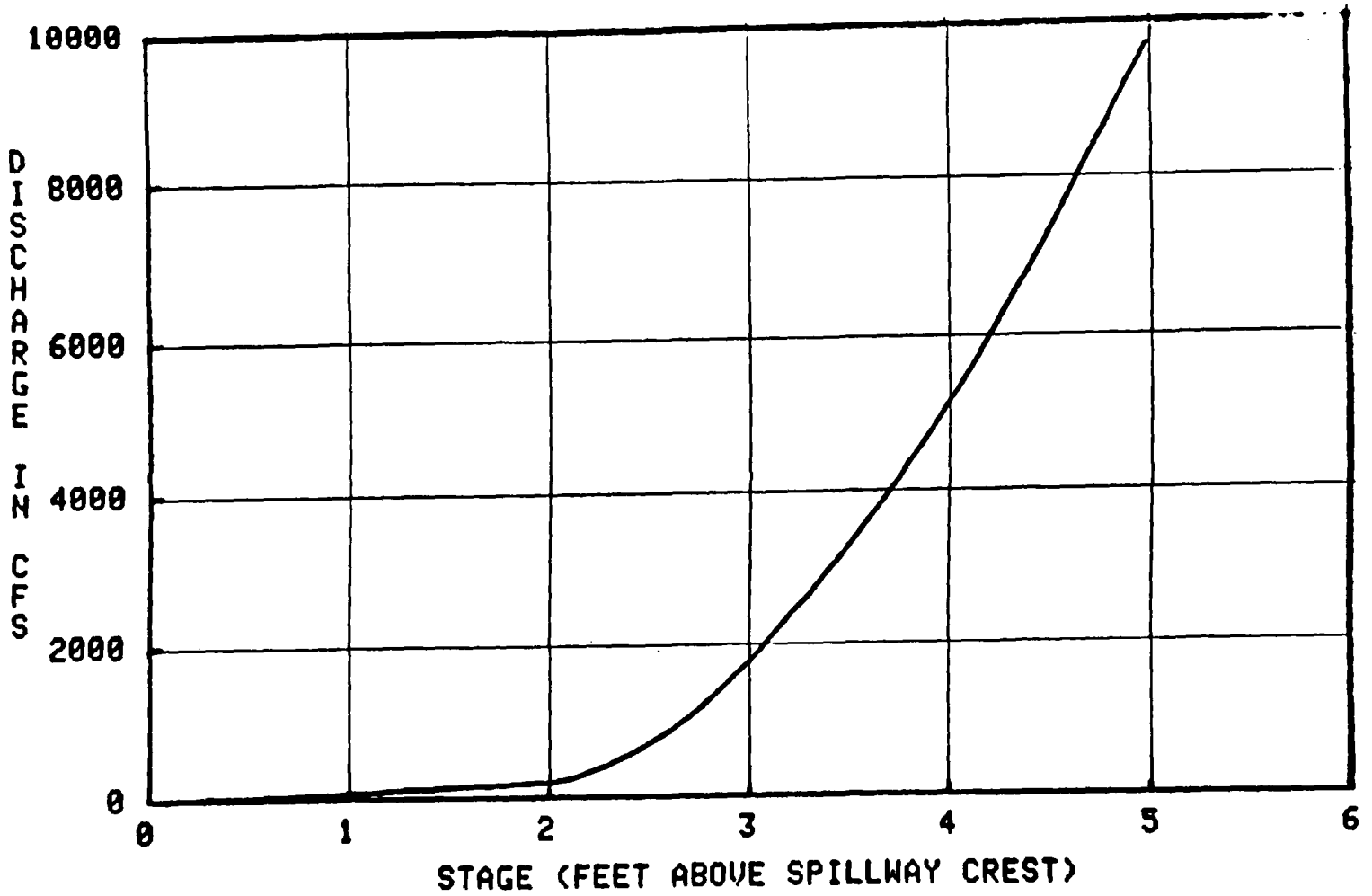
The BASIC program given on pp. 3-5 calculates the Stage-discharge relationship for the Dam.

```
LIST
100 REM - STAGE/DISCHARGE CURVE FOR GOOSE POND DAM
110 REM - STORED ON TAPE B-1 FILE 8
120 PAGE
130 PRINT USING 140:
140 IMAGE 10T"  STAGE/DISCHARGE RELATIONSHIP FOR GOOSE POND DAM    "
150 PRINT USING 160:
160 IMAGE //10T"HEAD"                45T"DISCHARGE"
170 PRINT USING 180:
180 IMAGE 1T"(FEET ABOVE S/W CREST)"47T"(CFS)"
190 PRINT USING 200:
200 IMAGE 26T "TOTAL   SPILLWAY    TOP OF DAM    SOUTH DIKE"
210 PRINT " "
220 FOR H=0 TO 5 STEP 0.2
230 Q1=0
240 Q2=0
250 Q3=0
260 Q4=0
270 Q5=0
280 Q6=0
290 Q2=3*23*H↑1.5
300 IF H<=2 THEN 380
310 Q1=2.8*(20*(H-2))*(0.5*(H-2))↑1.5
320 Q5=Q1
330 Q2=Q2+3*1.25*(H-2)↑1.5
340 Q3=2.8*200*(H-2)↑1.5
350 Q4=2.8*210*(H-2)↑1.5
360 IF H<=2.5 THEN 380
370 Q6=2.8*210*(H-2.5)↑1.5+2*2.8*3*(H-2.5)*(0.5*(H-2.5))↑1.5
380 T1=Q1+Q2+Q3+Q4+Q5+Q6
390 T2=Q1+Q3+Q4+Q5
400 PRINT USING 410:H,T1,Q2,T2,Q6
410 IMAGE 08T,3D.2D,17D,10D,14D,14D
420 NEXT H
430 END
```

STAGE/DISCHARGE RELATIONSHIP FOR GOOSE POND DAM

HEAD (FEET ABOVE S/W CREST)	DISCHARGE (CFS) TOTAL	SPILLWAY	TOP OF DAM	SOUTH DIKE
0.00	0	0	0	0
0.20	6	6	0	0
0.40	17	17	0	0
0.60	32	32	0	0
0.80	49	49	0	0
1.00	69	69	0	0
1.20	91	91	0	0
1.40	114	114	0	0
1.60	140	140	0	0
1.80	167	167	0	0
2.00	195	195	0	0
2.20	329	225	103	0
2.40	552	257	294	0
2.60	854	291	545	19
2.80	1267	326	844	97
3.00	1759	362	1188	209
3.20	2318	400	1572	347
3.40	2939	439	1993	507
3.60	3616	479	2452	686
3.80	4348	520	2944	883
4.00	5130	563	3471	1097
4.20	5962	606	4030	1326
4.40	6842	651	4622	1570
4.60	7768	696	5244	1827
4.80	8740	743	5898	2099
5.00	9756	791	6582	2383

STAGE-DISCHARGE CURVE FOR GOOSE POND DAM



Stage- Storage Curve

The storage with the water surface at the spillway crest is 522 Acre ft. Assuming a surface area of 42 acres and no spreading as the pond rises,

Surcharge storage = 42h

Total Storage = 522+42h

For the drainage area of 1.5 sq. mi = 960 Acres,

1" of runoff = 80 Ac-ft.

1 Ac ft = 1/80 = .0125" of runoff

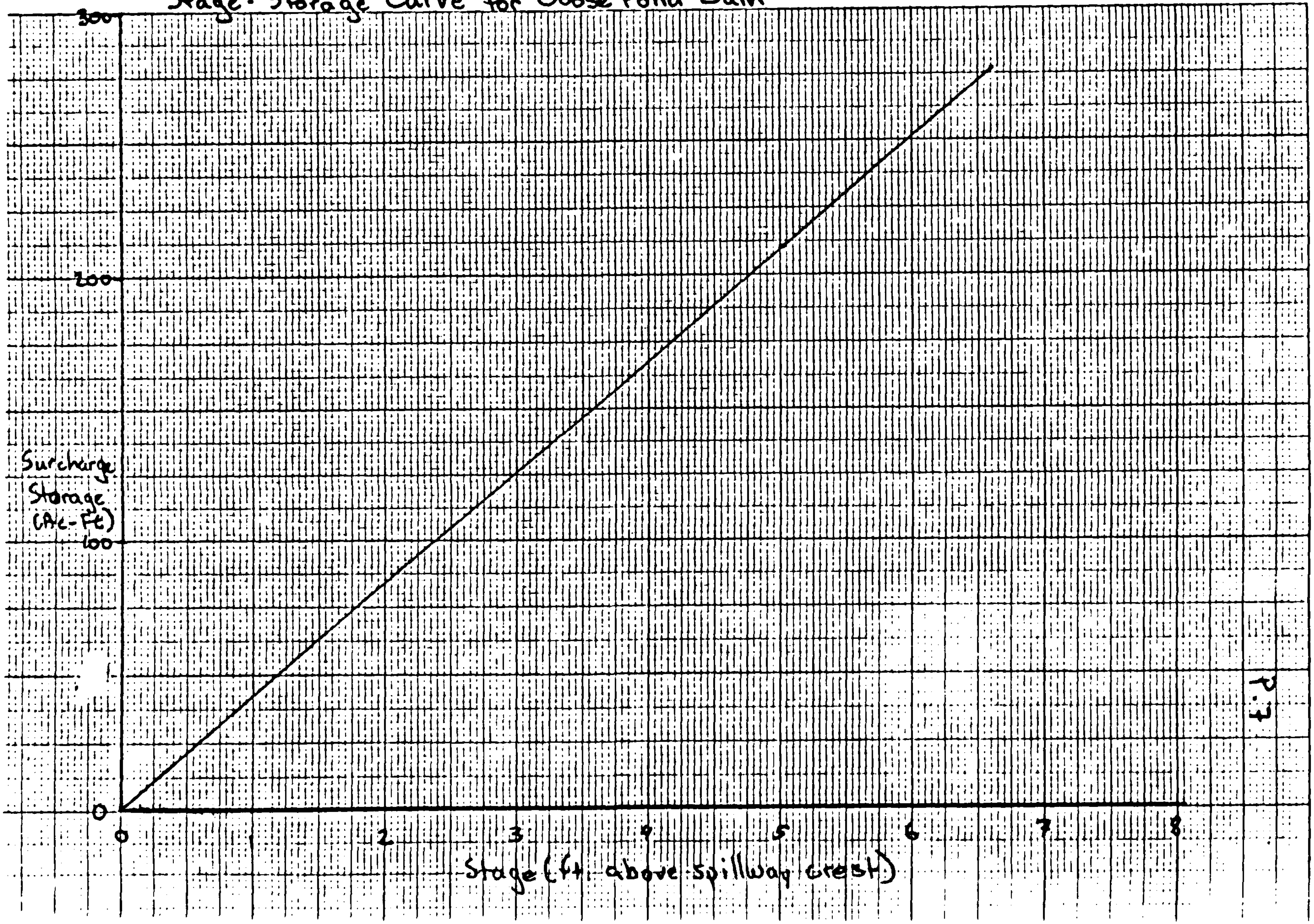
Surcharge storage to the top of the dam = 2(42) = 84 Ac-ft

= 1.05" of runoff.

At the top of the dam, total storage = 522+84 = 606 AF.

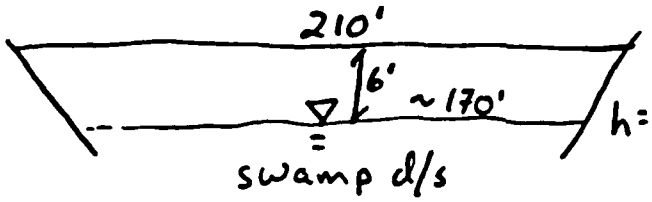
The stage-storage curve is given on p. 7.

Stage - Storage Curve for Goose Pond Dam



Dam Failure Analysis

There are two possible locations for failure at Goose Pond Dam - the main dam and the south dike. Let's look at the south Dike first:



Q_{p_1} = Peak Breach flow at failure 635ft MSL ±

$= 8/27\ W_b \sqrt{g}\ (y_o)^{3/2}$

$y_o = 6'$ (assuming swamp level to be the same as at inspection, failure with water surface at top of dike).

$W_b = .4(190) \cong 75'$ = assumed breach width

$Q_{p_1} = 8/27\ \ 75\ \sqrt{g}\ \ (6)^{3/2} = 1850$ cfs

This flows into the swamp just to the south of goose Pond, which has a surface area of about 20 acres. About 1200 feet downstream of the south dike, this swamp enters a small, unnamed brook, which runs about 4100 ft. to a small pond, on which several houses are located.

In order to estimate peak outflow from the ~~po~~ swamp just downstream of the dike, it is assumed that the storage in Goose pond at failure (= 522 Ac-Ft + 2.5(42) = 627 AF) is spread evenly across the swamp & Goose Pond at peak failure outflow

from the swamp. This overestimates peak stage in the swamp by neglecting headloss in the direction of flow and outflow from the swamp prior to peak. However, in this case the overestimate is slight.

total storage = 627 Ac-Ft. = Goose Pond + Swamp.

Goose pond storage = $522 + 42h$

Swamp storage = $20(h + 3.5) = 70 + 20h$

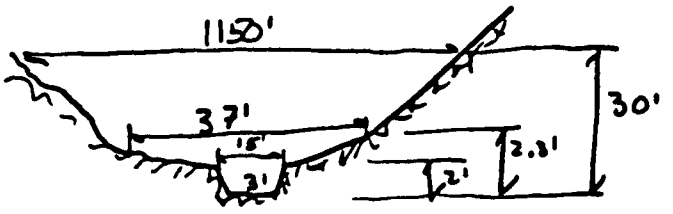
so $627 = 522 + 70 + 42h + 20h$

$62h = 35$

$h = .56$ ft.

This yields $3.5 + .56 \doteq 4.1$ ft of water in the swamp.

The flow downstream of the swamp would be controlled by the flow capacity of the stream section at the swamp's outlet. Based on USGS topo information, the stream section is assumed to be:

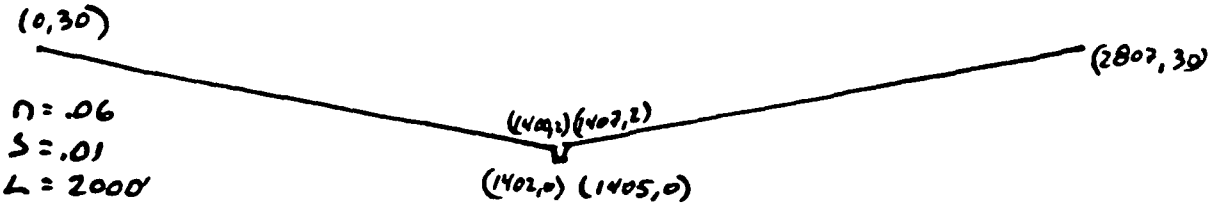


A Depth-Normal Flow relationship for this reach is given on p. 10. The elevation of 4.1 ft would give a flow of about 440 cfs. This flow would enter a 2000 ft. reach of the marsh with the following typical ~~se~~ cross-section:

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	4.0	5.8	0.7	3.1	7.7
2.00	2.0	10.0	8.7	1.2	11.0	27.3
3.00	3.0	52.3	66.7	0.8	44.5	110.4
4.00	4.0	137.3	106.7	1.3	162.4	403.3
5.00	5.0	262.3	146.8	1.8	386.3	959.3
6.00	6.0	427.3	186.8	2.3	741.9	1842.4
7.00	7.0	632.3	226.9	2.8	1252.6	3110.5
8.00	8.0	877.3	266.9	3.3	1940.0	4817.7
9.00	9.0	1162.3	307.0	3.8	2824.7	7014.6
10.00	10.0	1487.3	347.0	4.3	3926.0	9749.5
11.00	11.0	1852.3	387.1	4.8	5262.6	13068.7
12.00	12.0	2257.3	427.1	5.3	6852.3	17016.6
13.00	13.0	2702.3	467.2	5.8	8712.5	21636.1
14.00	14.0	3187.3	507.2	6.3	10859.9	26968.7
15.00	15.0	3712.3	547.3	6.8	13310.7	33054.8
16.00	16.0	4277.3	587.3	7.3	16080.8	39933.9
17.00	17.0	4882.3	627.4	7.8	19185.6	47644.3
18.00	18.0	5527.3	667.4	8.3	22640.3	56223.5
19.00	19.0	6212.3	707.5	8.8	26459.7	65708.3
20.00	20.0	6937.3	747.5	9.3	30658.3	76134.7
21.00	21.0	7702.3	787.6	9.8	35250.2	87538.0
22.00	22.0	8507.3	827.6	10.3	40249.5	99952.8
23.00	23.0	9352.3	867.7	10.8	45669.8	113413.4
24.00	24.0	10237.3	907.7	11.3	51524.8	127953.3
25.00	25.0	11162.3	947.8	11.8	57827.7	143605.6
26.00	26.0	12127.3	987.8	12.3	64591.7	160402.7
27.00	27.0	13132.3	1027.9	12.8	71829.6	178376.9
28.00	28.0	14177.3	1067.9	13.3	79554.3	197559.9
29.00	29.0	15262.3	1108.0	13.8	87778.3	217982.8
30.00	30.0	16387.3	1148.0	14.3	96514.1	239676.7

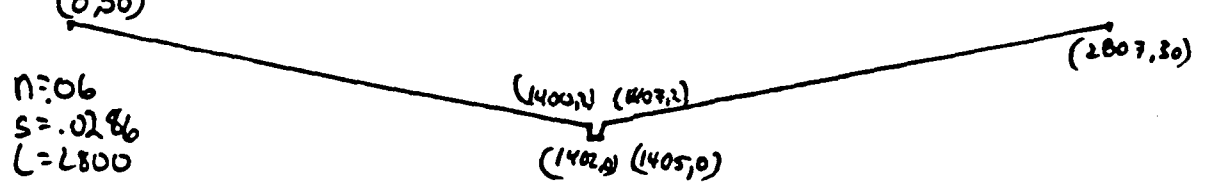
CONTROL SECTION, OUTLET OF SWAMP

P.10



The Depth-Normal flow relationship for this reach is given on the next page (p.12). The normal depth for 440 cfs is 3.7 ft. With flow at this depth, reach storage volume is (177 sq ft)(2000 ft)/43560 = 8.12 AF → negligible attenuation.

The 2800 ft. reach from the end of this reach to the pond has the following typical cross-section:



The Depth-Normal flow relationship for this reach is given on p.13. Again, attenuation is negligible - and the normal flow depth is 3.3 ft.

The peak failure outflow of 440 cfs would enter the small pond on the northern outskirts of Keene. This pond is shown in plan view on p.14. The two areas at which dam failure flows from the South Dike seem most dangerous are the houses at the upstream end of the pond, and the box culvert at Rte 12A, which might be threatened if the dam on the upstream pond were to fail due to dam failure flows.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	4.0	5.8	0.7	3.1	7.7
2.00	2.0	10.0	8.7	1.2	11.0	27.3
3.00	3.0	67.0	108.7	0.6	48.5	120.5
4.00	4.0	224.0	208.7	1.1	234.8	583.2
5.00	5.0	481.0	308.7	1.6	646.5	1605.6
6.00	6.0	838.0	408.7	2.1	1352.7	3359.3
7.00	7.0	1295.0	508.8	2.5	2415.0	5997.2
8.00	8.0	1852.0	608.8	3.0	3889.8	9659.6
9.00	9.0	2509.0	708.8	3.5	5830.0	14477.9
10.00	10.0	3266.0	808.8	4.0	8285.7	20576.1
11.00	11.0	4123.0	908.8	4.5	11304.5	28072.8
12.00	12.0	5080.0	1008.9	5.0	14932.1	37081.3
13.00	13.0	6137.0	1108.9	5.5	19212.6	47711.2
14.00	14.0	7294.0	1208.9	6.0	24188.6	60068.3
15.00	15.0	8551.0	1308.9	6.5	29901.4	74255.2
16.00	16.0	9908.0	1408.9	7.0	36391.3	90371.8
17.00	17.0	11365.0	1509.0	7.5	43697.5	108515.5
18.00	18.0	12922.0	1609.0	8.0	51858.3	128781.4
19.00	19.0	14579.0	1709.0	8.5	60911.0	151262.3
20.00	20.0	16336.0	1809.0	9.0	70892.4	176049.5
21.00	21.0	18193.0	1909.0	9.5	81838.4	203232.1
22.00	22.0	20150.0	2009.1	10.0	93784.4	232898.0
23.00	23.0	22207.0	2109.1	10.5	106765.0	265133.2
24.00	24.0	24364.0	2209.1	11.0	120814.4	300022.4
25.00	25.0	26621.0	2309.1	11.5	135966.1	337649.1
26.00	26.0	28978.0	2409.1	12.0	152253.2	378095.5
27.00	27.0	31435.0	2509.2	12.5	169708.3	421442.4
28.00	28.0	33992.0	2609.2	13.0	188363.7	467769.8
29.00	29.0	36649.0	2709.2	13.5	208250.9	517156.4
30.00	30.0	39406.0	2809.2	14.0	229401.4	569680.2

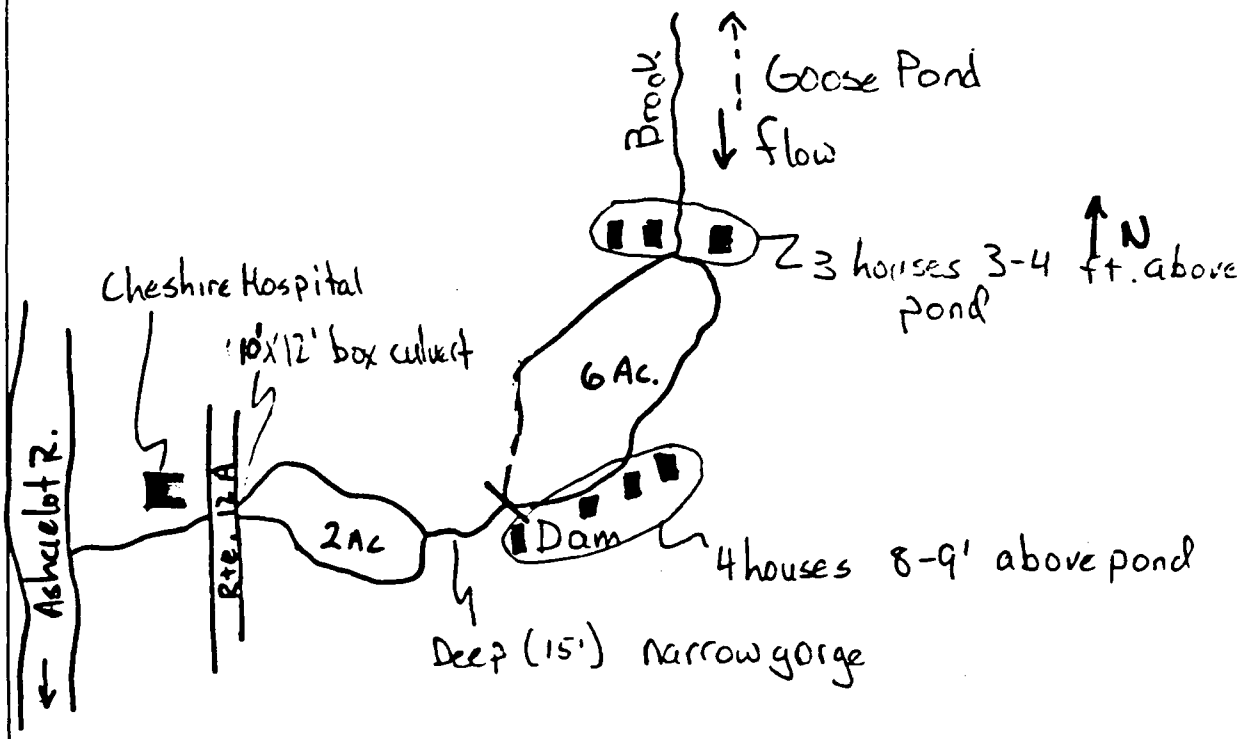
REACH FROM SWAMP 2000 FT. DOWNSTREAM

P.12

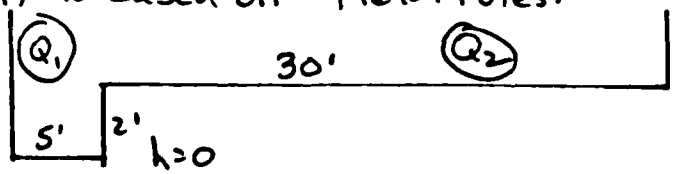
DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	4.0	5.8	0.7	3.1	13.1
2.00	2.0	10.0	8.7	1.2	11.0	46.2
3.00	3.0	67.0	108.7	0.6	48.5	203.8
4.00	4.0	224.0	208.7	1.1	234.8	986.2
5.00	5.0	481.0	308.7	1.6	646.5	2715.3
6.00	6.0	838.0	408.7	2.1	1352.7	5681.1
7.00	7.0	1295.0	508.8	2.5	2415.0	10142.1
8.00	8.0	1852.0	608.8	3.0	3889.8	16335.9
9.00	9.0	2509.0	708.8	3.5	5830.0	24484.3
10.00	10.0	3266.0	808.8	4.0	8285.7	34797.4
11.00	11.0	4123.0	908.8	4.5	11304.5	47475.4
12.00	12.0	5080.0	1008.9	5.0	14932.1	62710.3
13.00	13.0	6137.0	1108.9	5.5	19212.6	80687.0
14.00	14.0	7294.0	1208.9	6.0	24188.6	101584.7
15.00	15.0	8551.0	1308.9	6.5	29901.4	125576.9
16.00	16.0	9908.0	1408.9	7.0	36391.3	152832.6
17.00	17.0	11365.0	1509.0	7.5	43697.5	183516.4
18.00	18.0	12922.0	1609.0	8.0	51858.3	217789.0
19.00	19.0	14579.0	1709.0	8.5	60911.0	255807.8
20.00	20.0	16336.0	1809.0	9.0	70892.4	297726.7
21.00	21.0	18193.0	1909.0	9.5	81838.4	343696.7
22.00	22.0	20150.0	2009.1	10.0	93784.4	393866.2
23.00	23.0	22207.0	2109.1	10.5	106765.0	448380.9
24.00	24.0	24364.0	2209.1	11.0	120814.4	507383.9
25.00	25.0	26621.0	2309.1	11.5	135966.1	571016.5
26.00	26.0	28978.0	2409.1	12.0	152253.2	639417.4
27.00	27.0	31435.0	2509.2	12.5	169708.3	712723.8
28.00	28.0	33992.0	2609.2	13.0	188363.7	791070.5
29.00	29.0	36649.0	2709.2	13.5	208250.9	874590.9
30.00	30.0	39406.0	2809.2	14.0	229401.4	963416.6

REACH FROM 2000 FT. DOWNSTREAM OF SWAMP TO LITTLE POND W/ HOUSES

P.13



The dam of the upstream reservoir is an old masonry structure in somewhat deteriorated condition. The following elevation is based on field notes:



for $h > 0$

$$Q_1 = 3.0\,(5)\,(h)^{3/2}$$

for $h > 2$

$$Q_2 = 3.0\,(30)\,(h)^{3/2}$$

C = 3.0 for B.C. masonry spillway

A BASIC program to calculate the stage-discharge relationship for this dam is given on p. 15. The attenuation of peak dam failure flows in this pond would be negligible, so the

```
list
100 REM - stage discharge curve for small pond
110 PRINT "J       stage                          discharge"
120 PRINT "(feet above s/w crest)                   (cfs)"
130 PRINT "                                  total     spillway    top of dam"
140 PRINT " "
150 FOR H=1 TO 5 STEP 0.5
160 Q2=0
170 Q1=3*5*H↑1.5
180 IF H<=2 THEN 200
190 Q2=3*30*(H-2)↑1.5
200 T1=Q1+Q2
210 PRINT USING 220:H,T1,Q1,Q2
220 IMAGE 09d.1d,20d,12d,12d
230 NEXT H
240 END

run

        stage                          discharge
(feet above s/w crest)                   (cfs)
                                  total     spillway    top of dam

          1.0                      15          15           0
          1.5                      28          28           0
          2.0                      42          42           0
          2.5                      91          59          32
          3.0                     168          78          90
          3.5                     264          98         165
          4.0                     375         120         255
          4.5                     499         143         356
          5.0                     635         168         468
```


P.15

peak stage generated by the 440 cfs dam failure in flow would be 4.3 feet over the spillway crest - 2.3 feet over the top of the dam. This would cause slight flooding at the 3 houses at the upstream end of the pond. Since the flooding would not be flowing rapidly, the threat of loss of life at these houses is slight.

If this stage were to cause dam failure, the peak outflow would increase *:

$$Q_{p_T} = \text{Failure flow} + \text{Normal Flow}$$

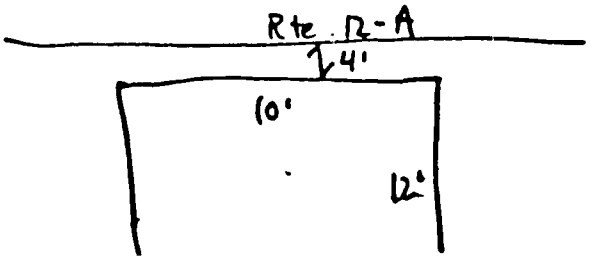
$$= 8/27\, W_b \sqrt{g}\, (Y_0)^{3/2} + 440 \text{ cfs}$$

W_b = breech width = .4 (25) = 10 ft.

$Y_0 \doteq 15$ ft.

$$Q_{p_1} = 8/27\,(10)\sqrt{g}\,(15)^{3/2} + 440 = 1420 \text{ cfs}$$

This flow would not threaten the houses around the downstream pond, which are well above the pond surface. This second pond is created by the culvert under Rte 12-A a 10'X12' concrete box culvert:



According to the FHA's Hydraulic Engineering Circular 13, this culvert would have a capacity of about 1800 cfs, ~~since~~ with the water surface at the top of the road. Since the peak inflow to the pond above the culvert is only 1420 cfs even if the upstream dam fails, and since there would be some attenuation in this pond, dam failure flows do not seem to threaten ~~the~~ ~~the~~ damage to Rte. 12-A.

Once past Rte. 12-A, the brook runs 1500 feet to the Ashuelot River, in which the flows created by the failure of the South Dike would quickly dissipate, with or without additional flows from the failure of the masonry dam. There is no development threatened by flooding in the reach from Rte. 12-A to the Ashuelot.

To summarize, the only development downstream of the South Dike which is threatened by dam failure flows is at a small pond in north Keene, about 6000 ft. downstream of the dike. Three houses currently under construction would experience minor flooding due to dam failure flows, and the old masonry dam which creates the pond would be overtopped and possibly damaged or destroyed

Main Dam

The development downstream of the main dam is shown on p.1. ~~Although the~~ The outflow from the Goose Pond Dam spillway does not join the stream immediately downstream of the dam. The spillway stream and the stream from the main dam rejoin about 1500 ft. downstream, just upstream of East Surry Rd.

Assuming that failure occurs with the water surface at the dam crest, the pre-failure outflow would be 195 cfs through the spillway. Peak failure flow: normal flow + Q_{p_1}

$$Q_{p_1} = 8/27\, W_b \sqrt{g}\, y_o^{3/2}$$

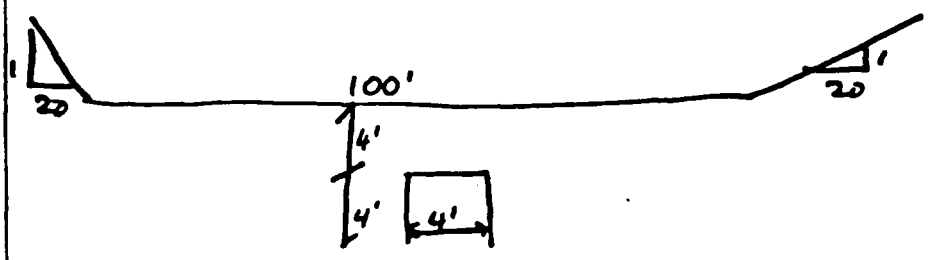
$W_b = .4\,(100) = 40$ ft.

$y_o = 23$

$Q_{p_1} = 8/27\,(40)\sqrt{g}\,23^{3/2} = 7{,}400$ cfs

Storage: $522 + 42(2) = 606$ Ac-ft.

This flow would not be significantly attenuated by downstream storage, and would increase to about 7600 cfs when rejoined by the spillway flow about 1500 ft. downstream. The only downstream development threatened by flooding ~~the~~ before the small stream joins the Ashuelot is a house just upstream of East Surry Rd. about 2000 ft. downstream of the dam. East Surry Rd. embankment would control flood elevations at the house. The following elevation of the embankment is based on field notes:



The stage-Discharge relationship for this section is given below:

Stage (ft. above channel bottom)	$Q_{culvert}$ (cfs) (from FHWA HEC-13)	Q_{road} (cfs) $Q = 2.8(100)(h-8)^{1.5} + 2(2.8)(20)^{(h-8)}(.5(h-8))^{1.5}$	Total (cfs)
8	180	0	180
9	195	320	515
10	210	1016	1226
11	225	2072	2297
12	240	3508	3748
13	250	5344	5594
14	260	7607	7867

Assuming that the embankment were to hold, the water surface would rise to 13.9 ft. above the channel, 5.9ft. above the road. This would approach the house, which is 6 ft. above the road. However, it is likely that the embankment would fail long before the water surface reached this level, reducing ~~dow~~ the peak stage over the road.

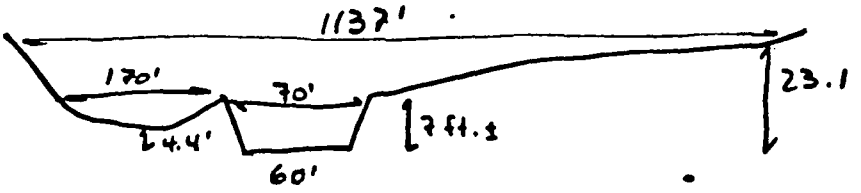
After passing ~~the~~ East Surry Rd., the brook runs

about 1700 ft. to the Ashuelot River. There is no development threatened by flooding in this reach.

In the larger Ashuelot, dam failure flows would begin to be attenuated by storage. The first development downstream which might be affected by dam failure flows is a trailer park about 3200 ft. from the mouth of Goose Pond Dam's Brook, just downstream of the Court St. Bridge in Keene. The typical x-section for this reach is taken from 1978 ANCO FIS work.

In the analysis on the Ashuelot, it is assumed that normal pre-failure flow on the Ashuelot is negligible beside the 7600cfs failure flow expected from Goose Pond. Large pre-failure flows on the Ashuelot (the 100 flow is about 2200 cfs) would add to expected dam

L=3200'
n= .05
s= .00075



Approximate cross-section.

The stage-normal flow curve for this reach is given on p. 21, and the attenuation due to storage is calculated on p. 22. The attenuated peak failure flow of 5560 cfs might harm the Court St. Bridge, but the major damage would come in the trailer park downstream. The cross-section at this trailer

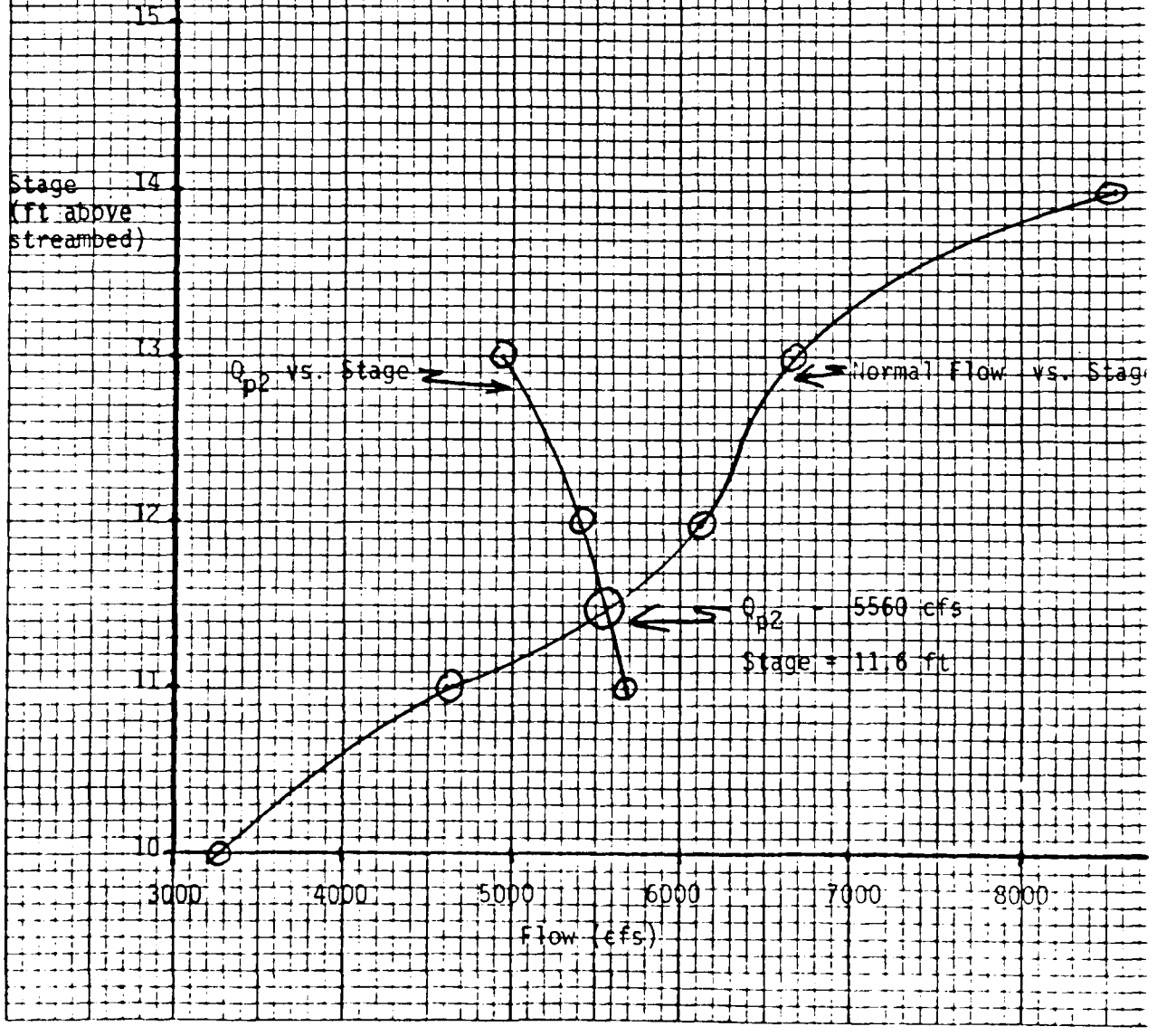
DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	471.1	0.0	0.0	0.0	0.0	0.0
1.00	472.1	60.2	62.1	1.0	59.1	48.2
2.00	473.1	121.0	64.1	1.9	184.7	150.7
3.00	474.1	182.1	66.2	2.8	357.9	292.1
4.00	475.1	243.8	68.2	3.6	570.1	465.3
5.00	476.1	326.4	136.7	2.4	583.4	476.1
6.00	477.1	479.0	175.8	2.7	934.9	763.0
7.00	478.1	663.3	214.3	3.1	1409.2	1150.0
8.00	479.1	903.6	282.8	3.2	1960.9	1600.3
9.00	480.1	1214.6	359.8	3.4	2734.7	2231.8
10.00	481.1	1586.1	391.2	4.1	4035.2	3293.2
11.00	482.1	1977.8	410.4	4.8	5645.8	4607.6
12.00	483.1	2388.5	429.7	5.6	7499.6	6120.5
13.00	484.1	2901.3	615.1	4.7	8163.8	6662.6
14.00	485.1	3577.8	715.1	5.0	10471.9	8546.2
15.00	486.1	4289.9	729.5	5.9	13984.2	11412.6
16.00	487.1	5016.1	744.0	6.7	17913.7	14619.5
17.00	488.1	5756.5	758.4	7.6	22247.9	18156.7
18.00	489.1	6554.3	868.7	7.5	25230.2	20590.6
19.00	490.1	7463.3	945.6	7.9	29605.8	24161.5
20.00	491.1	8402.8	956.5	8.8	35800.4	29217.0
21.00	492.1	9353.0	967.5	9.7	42477.0	34665.8
22.00	493.1	10384.3	1112.8	9.3	46062.5	37591.9
23.00	494.1	11501.4	1146.2	10.0	53547.6	43700.6

reach from brook mouth to trailer park (Ashuelot River)

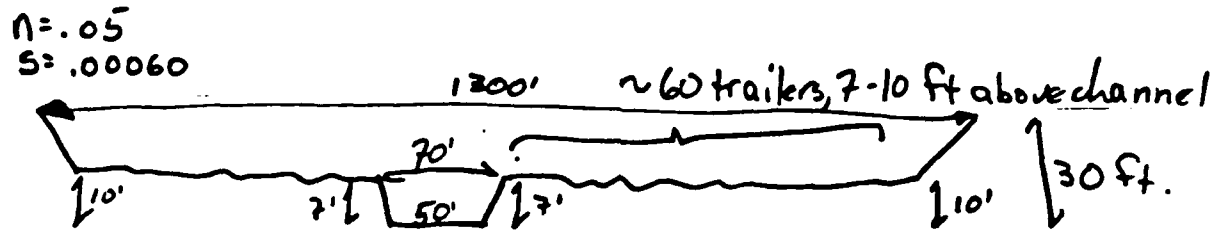
P.21

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{606}\right) = 7600\left(1 - \frac{STOR}{606}\right)$$

Stage (ft)	Area (sq ft)	Storage $\left(\frac{AREA \times 3200}{43,560}\right)$ (ac ft)	Q_{p2} (cfs)
11	1978	145.3	5780
12	2389	175.5	5400
13	2901	213.1	4930



park is shown below (again based on 1978 Anco FIS work)



Approximate x-sect. Not to Scale

The Stage-Discharge relationship for this reach is given on p. 24. The peak failure flow of 5560 cfs would create a stage of about 11ft (481 ft msl ±) in this reach. This would cause 1-3½ feet of flooding at the trailers, causing serious damage and a threat of serious loss of life. There are about 60 trailers in the low-lying part of the trailer park which might be affected by dam failure flows. Also, if the wave came on top of already significant Ashuelot River flows, damage might be even greater.

Downstream of the trailer park, the Ashuelot River flood-plain is relatively undeveloped - except for some residences on the fringe of the 100 yr. flood-plain - for the 14,000 ft. (±) down to Faulkner & Colony Dam. In this winding, flat reach with an extensive floodplain, dam failur flows from Goose Pond Dam should largely attenuate. Although some damage might occur in central Keene downstrea of Mt. Faulkner & Colony Dam further minor flooding is not likel

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	469.9	0.0	0.0	0.0	0.0	0.0
1.00	470.9	50.2	52.1	1.0	49.1	35.8
2.00	471.9	101.0	54.1	1.9	153.0	111.7
3.00	472.9	152.1	56.2	2.7	295.7	215.9
4.00	473.9	203.8	58.2	3.5	470.1	343.1
5.00	474.9	257.9	64.3	4.0	651.6	475.6
6.00	475.9	345.6	131.5	2.6	658.4	480.6
7.00	476.9	485.6	185.1	2.6	924.1	674.6
8.00	477.9	754.6	421.3	1.8	1113.1	812.5
9.00	478.9	1464.0	862.1	1.7	2084.1	1521.3
10.00	479.9	2415.3	1055.2	2.3	4196.1	3062.9
11.00	480.9	3491.7	1105.1	3.2	7521.3	5490.2
12.00	481.9	4603.9	1138.3	4.0	11692.3	8534.8
13.00	482.9	5737.4	1148.1	5.0	16779.6	12248.2
14.00	483.9	6880.3	1157.8	5.9	22586.9	16487.2
15.00	484.9	8032.8	1167.5	6.9	29076.7	21224.5
16.00	485.9	9194.6	1177.2	7.8	36219.6	26438.4
17.00	486.9	10366.0	1187.0	8.7	43991.5	32111.5
18.00	487.9	11546.8	1196.7	9.6	52372.6	38229.3
19.00	488.9	12737.0	1206.4	10.6	61345.9	44779.3
20.00	489.9	13936.7	1216.2	11.5	70896.9	51751.1
21.00	490.9	15145.9	1225.9	12.4	81013.1	59135.3
22.00	491.9	16364.6	1235.6	13.2	91683.5	66924.1
23.00	492.9	17592.7	1245.3	14.1	102898.3	75110.4
24.00	493.9	18830.2	1255.1	15.0	114649.0	83687.8
25.00	494.9	20077.2	1264.8	15.9	126927.9	92650.7
26.00	495.9	21333.7	1274.5	16.7	139728.1	101994.3
27.00	496.9	22599.7	1284.3	17.6	153043.5	111713.8
28.00	497.9	23875.1	1294.0	18.5	166868.5	121805.3
29.00	498.9	25159.9	1303.7	19.3	181198.1	132265.2
30.00	499.9	26454.2	1313.5	20.1	196027.6	143090.0

reach at trailer park - Ashuelot River

P.24

The following chart summarizes the effects of the failure of Goose Pond Dam & its south dike.

Location & # (see map at end of App.)	# of dwellings	level above streambed (ft.)	Flow & Stage Before failure	Flow & Stage After failure	Comments
Main Dam					
tailwater	0	-	0 0	7400 cfs -	
① East Surry Rd.	Rd. 1 house	8 ft. 14 ft.	200 cfs 8.2 ft	7600 cfs 14 ft.	14 ft. if roadway holds, which is not likely. Probable damage to Road.
Confluence with Ashuelot	-	-	200 cfs -	7600 cfs -	
② Trailer park	60 trailers	7-10 ft.	* *	5560 cfs 11 ft	Severe flooding, high possibility of loss of life. Ashuelot could add to problem if already at high flow.
D/s	-	-	-	-	14000 ft ± to Keene center. Probably attenuated without additional major damage
South Dike					
③ Small pond 6000 ft d/s	3 dam	3 ft. above s/w crest 2 ft. freeboard	- -	440 cfs 4 ft over s/w crest	Slight flooding at houses if dam holds. 2 ft. flow over dam crest → possible failure. No development threatened d/s.

* assumed negligible compared to failure flows

Size Classification: Small (Storage between 50 & 1000 AF, height less than ~~25~~ 40 ft)

Hazard Classification: Main Dam - HIGH based on the potential for economic losses and loss of life due to dam failure (see dam failure analysis section)

South Dike - SIGNIFICANT - based on the possible slight flooding to houses 6000 ft d/s at small pond (see dam failure analysis section).

for test flood use Main Dam Hazard Classification, → ½PMF to PMF. Since hazard is on the High side of HIGH, use the PMF.

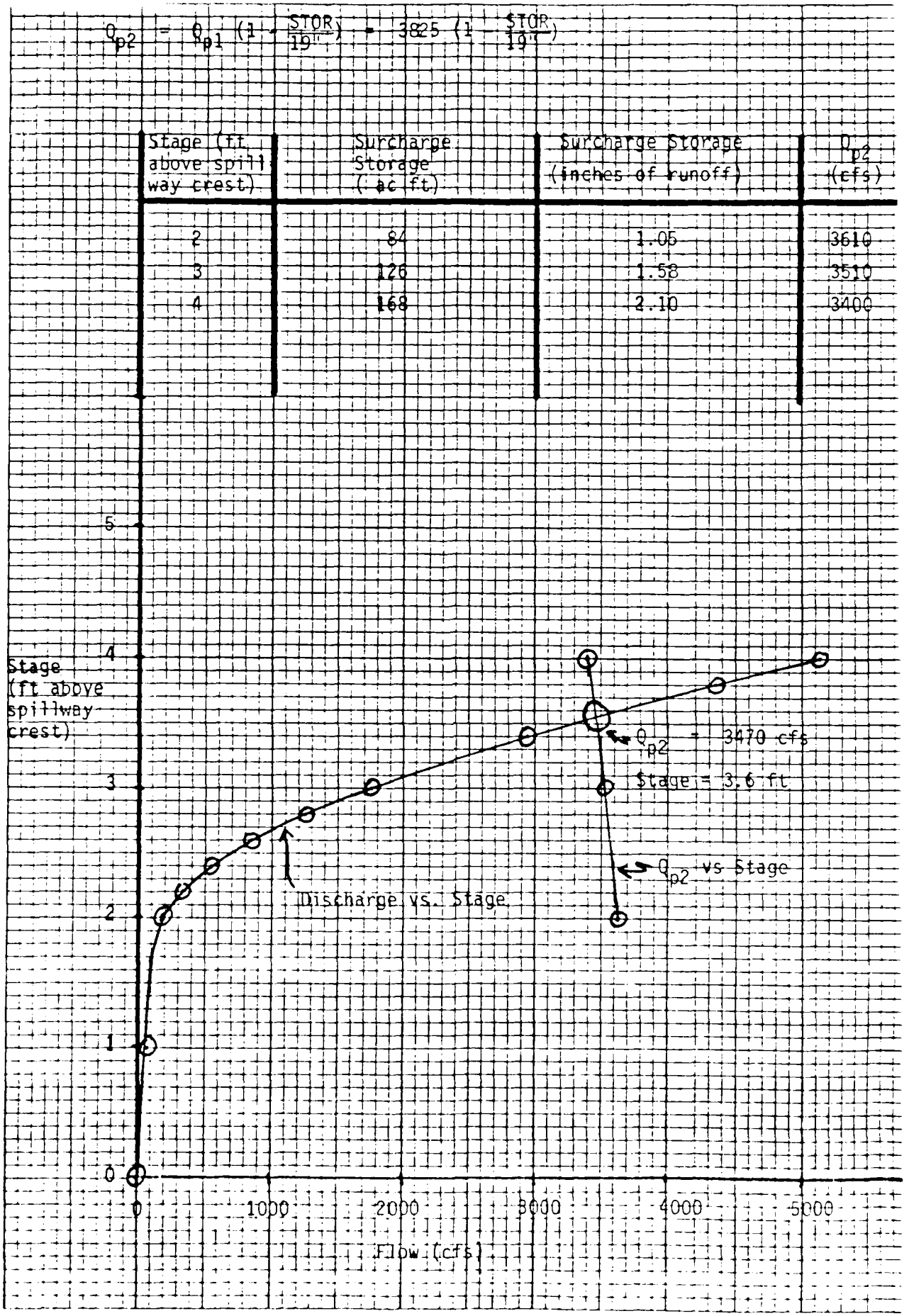
Using the COE NED "Maximum Probable flood Peak Flow Rates", the upstream drainage area of 960 Acres (1.5 Sq.mi) of mountainous terrain would yield a peak inflow of 2550 CSM.

Peak inflow: $(1.5)(2550) = 3825$ cfs

The attenuation due to storage of the Test Flood is calculated on p.27. The test flood outflow of 3470 cfs would create a stage 3.6 ft. over the spillway crest, 1.6 ft. over the dam crest, at elevation 638.6 ft msl. This would be 1.1 feet over the South Dike.

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{19}\right) + 3625\left(1 - \frac{STOR}{19}\right)$$

Stage (ft above spillway crest)	Surcharge Storage (ac ft)	Surcharge Storage (inches of runoff)	Q_{p2} (cfs)
2	84	1.05	3610
3	126	1.58	3510
4	168	2.10	3400



Degree of overtopping at 100 year Flood

For the purpose of comparison with spillway capacity, we will estimate the 100 yr. inflow to the reservoir using Dennis LeBlanc's © USGS WRI 78-47, "Preliminary Relations for Estimating Peak Discharges on Rural, Unregulated Streams":

$$P_{100} = .55\, A^{1.05}\, S^{.56}\, I^{2.72}$$

A = drainage area in Sq. mi = 1.5

I = max. 2 yr. 24 hr. precip. = 3.1

S = U/s slope, ft/mile = 280

P_{100} = 430 cfs

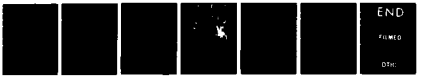
The attenuated 100 year reservoir outflow is calculated on p. 29 The attenuated peak outflow of 330 cfs exceeds the spillway capacity by 69%, and overtops the dam crest by .2 feet.

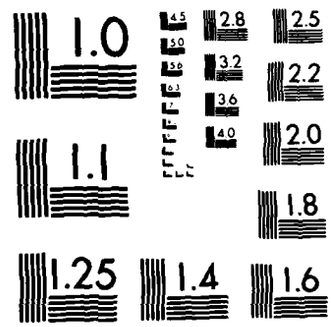
Degree of Overtopping at 1/2 PMF

The 1/2 PMF = 1/2 (3825) = 1910 cfs inflow. The attenuation due to storage is calculated on p. 30. The outflow of 1600 cfs would include 350 cfs over the spillway, 175 cfs over the South Dike, and 1075 cfs over the Main Dam Crest. The main dam crest would be overtopped by 0.9 ft, and the South Dike by .0.4 ft.

AD-A156 450 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS GOOSE POND DAM (NH 00. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 80 2/2

UNCLASSIFIED F/G 13/13 NL

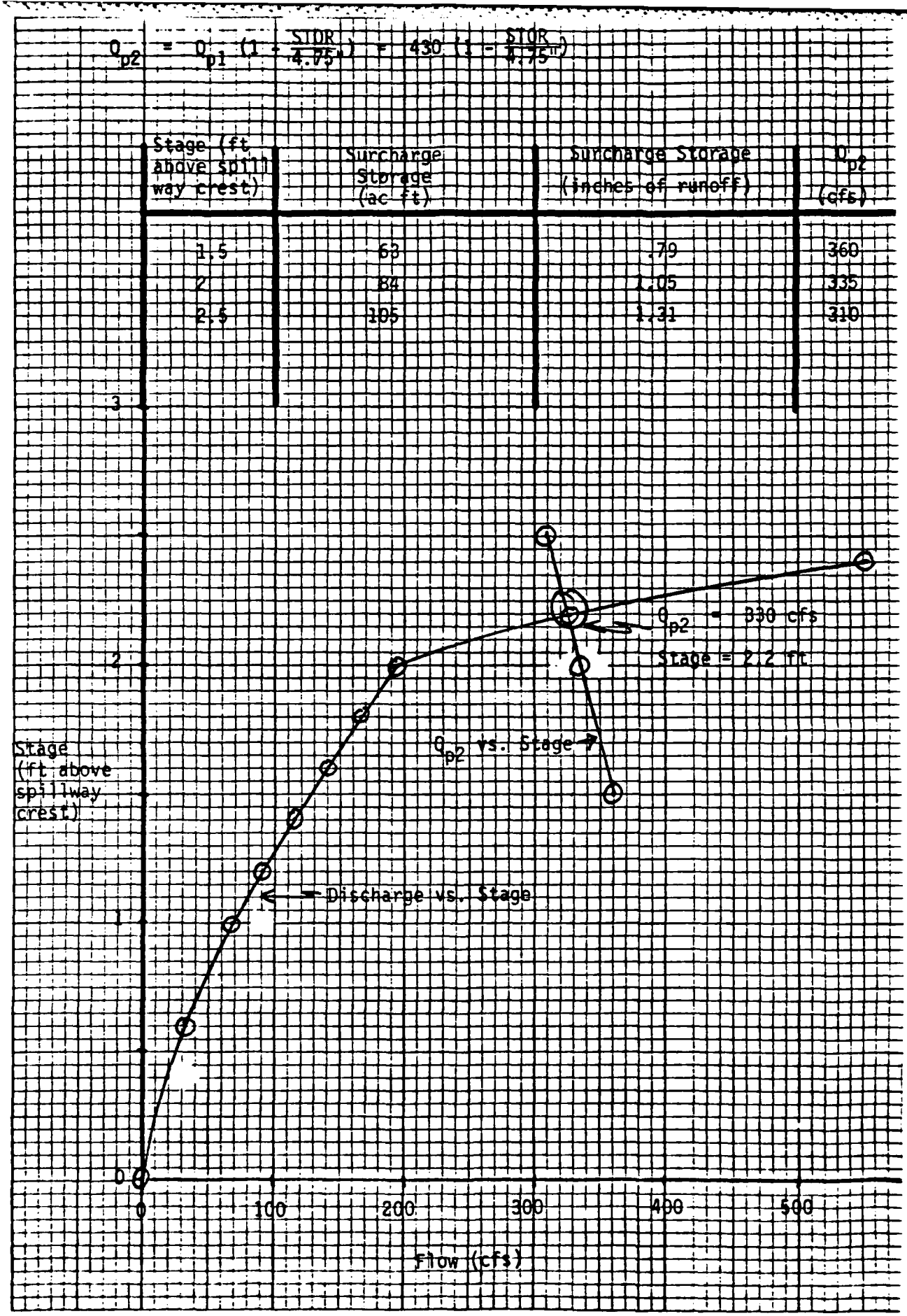




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

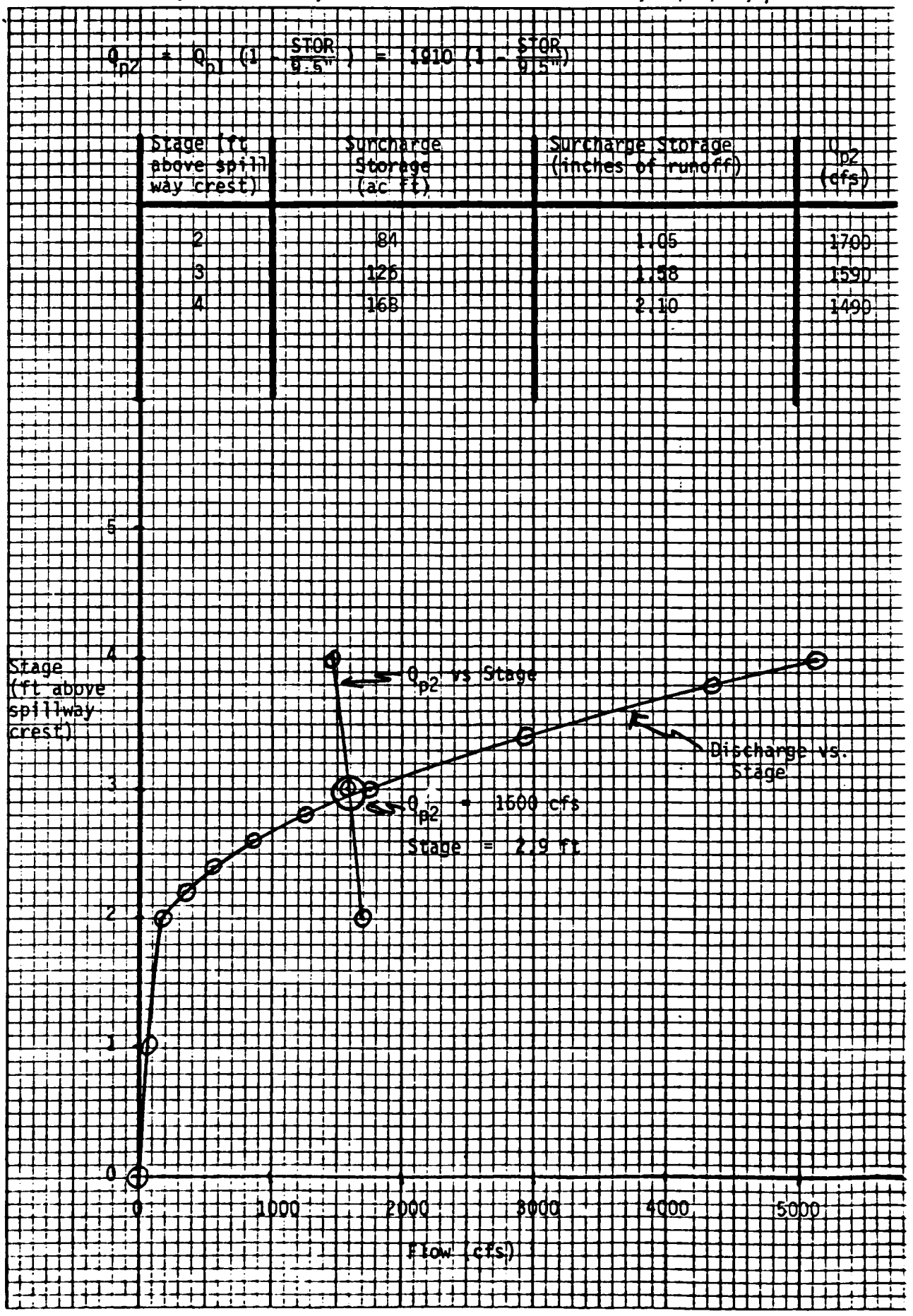
$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{4.75}\right) = 430\left(1 - \frac{STOR}{4.75''}\right)$$

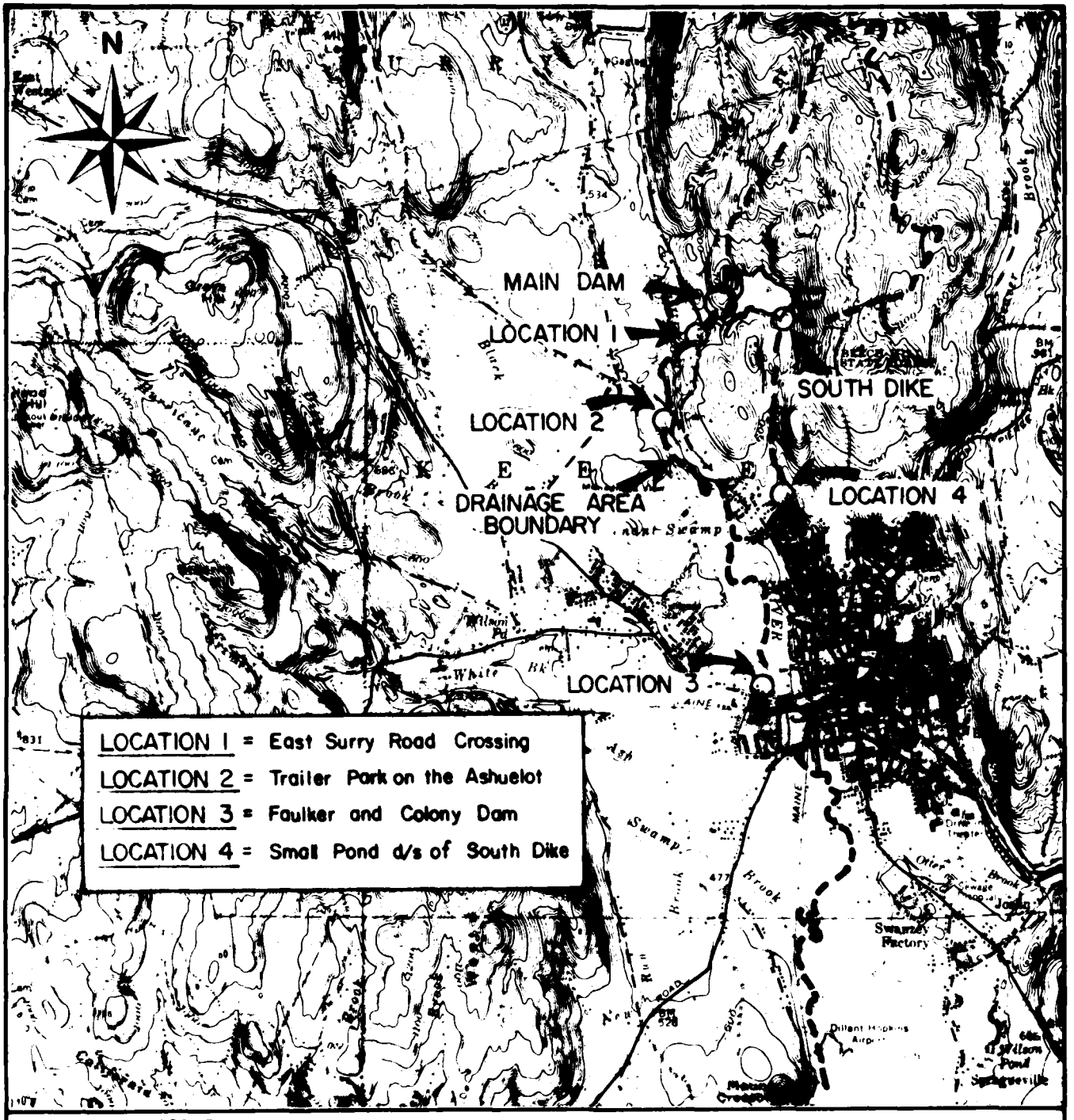
Stage (ft above spillway crest)	Surcharge Storage (ac ft)	Surcharge Storage (inches of runoff)	Q_{p2} (cfs)
1.5	63	.79	360
2	84	1.05	335
2.5	105	1.31	310



$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{9.5''}\right) = 1910\left(1 - \frac{STOR}{9.5''}\right)$$

Stage (ft above spillway crest)	Surcharge Storage (ac ft)	Surcharge Storage (inches of runoff)	Q_{p2} (cfs)
2	84	1.05	1700
3	126	1.58	1590
4	168	2.10	1490





– SCALE –

0 1/2 1 2 (MILES)

FROM: USGS KEENE - N.H. QUADRANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

FILE No. 2327

GOOSE POND DAM — NEW HAMPSHIRE

SCALE	AS NOTED
DATE	DECEMBER 1979

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NH	101	NED	NH	005	02				GOOSE POND DAM	4258.2	7217.7	17	DEC	79

POPULAR NAME	NAME OF IMPOUNDMENT
	GOOSE POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	TRASHUELOT RIVER	KEENE	2	22000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
PGHEOT	1868	H	23	23	606	522	NED	N	N	N	N	

REMARKS
21'w/CONC SPILLWAY

DAMS	SPILLWAY LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	210	U	23	195												

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF KEENE NH		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
GOLDBERG ZOINO DUNNICLIFF + ASSOC	21	AUG	79	PL 92-367

REMARKS

END

FILMED

8-85

DTIC